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THE SOCIOTECHNICAL TRANSFORMATION OF THE LIVESTOCK MARKET IN TANZANIA

Appropriation of mobile phones by the Maasai and Wasukuma pastoralists

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Appropriation of mobile phones by the Maasai and Wasukuma pastoralists

Declaration of Originality of Submitted Work

In conformance to the regulations of the University of Edinburgh, I hereby declare that:

1. I am the sole author of this thesis;

2. This thesis is entirely my own work;

3. This thesis has not been submitted in part or whole for any other degree or professional qualification.

Signed: _____

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Dad your head is like a book, full of clever things!

Alicia

Abstract

This thesis presents findings from a qualitative enquiry into the rapid uptake of the mobile phone by pastoral communities in Tanzania and its use as a tool to tackle marketing constraints. The research design involves an interregional comparative analysis of two key production regions: Arusha and the Lake Zone, and two groups of livestock producers (the Maasai pastoralists and Wasukuma agro-pastoralists respectively).

Applying the Social Shaping of Technology (SST) perspective from Science and Technology Studies (STS), and in particular the concept of *'appropriation'*, the study examines the embrace of mobile phones by those producers – who keep livestock under the extensive (pastoralist) and semi-intensive (agro-pastoralist) systems respectively. The thesis examines the extent to which the mobile phone is changing how livestock keepers interact in the livestock market and how this is affecting their livelihoods.

The thesis shows that the significance of the mobile phone varies with user groups; for instance, for the Maasai who still lead a nomadic life, the mobile phone is used 'conservatively' to communicate about herd management and to coordinate household affairs in ways that do not substantially disrupt traditional social practices and roles. In contrast, the Wasukuma agro-pastoralists use mobile phones to introduce new processes to support production and marketing, one good example being the strategy used to coordinate transportation of cattle to market.

The study findings suggest the extension of the "*appropriation*" (Williams, Stewart, & Slack, 2005) conceptualisation by adding the possibility of a *spectrum* from *shallow* to *extended* according to users' role and the context of use. Nevertheless, and in more generic terms, it is possible to say that the mobile phone use did not disrupt some of the traditional practices and trade customs amongst the Maasai, and it has reinforced the innovative behaviour of the Wasukuma.

The thesis also examines a parallel initiative whereby aid agencies and public bodies in Tanzania supported the development of the Livestock Information Network and Knowledge System (LINKS), as an ICT platform designed to improve the livestock

market by sharing market information. However, studies show that LINKS has not had the intended effect, is not trusted and has not been adopted by many pastoralists.

The study shows how the concept of trust, which is key in market dynamics and trade relations, has been reshaped, because the mobile phone has supported informal communications that reinforce traditional methods of policing trust in the market.

The thesis contributes to ongoing debates surrounding the conceptualisation of Information and Communication Technologies for Development (ICT4D). The failure of early ICT4D initiatives was attributed to a failure to address users' specific requirements, due to gaps in the translation process, as well as to socio-political and technical fragilities such as the lack of adequate infrastructure, and a deficient social learning process. The initial reworking of ICT4D highlighted the need to design technology as a specific solution appropriate to particular contexts/user groups. These were seen as finished solutions (corresponding to the idea of a 'technical fix'). Focusing upon *'appropriation'*, in line with the Social Shaping of Technology – Mark 2 approach – allows scope for a further rethinking of ICT4D which addresses not just design but the active role of users in shaping technological innovation to the context and purposes of communities in developing countries.

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This thesis is the result of a long journey that took me across several countries. This journey gave me the chance to get to know different people living in different social realities and circumstances. All those that I will refer to in these lines of acknowledgements are part of this work, and they have been significant for the person that I am today. Academically, I should like above all to acknowledge the support of my two supervisors, Professor Robin Williams and Professor David Wield, to whom I am immeasurably grateful. Their knowledge, friendship and resilience paved the way that I will walk through in the future. Familiarly, to acknowledge the patience of my wife and my daughter, together with my mother, sisters, brother and nephews, who are my lighthouse, my support and my source of love. All of you are part of this work, and without your love and support I would not have been able to finish the journey. To my father, who is no longer alive, I will say just thank you, mainly for being a role model in what concerns dignity and ethics.

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"[…] *this device took us from the 17th century and brought us directly into the 21st century."*

Timothy Oleyaile,
Maasai livestock keeper

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Abbreviations

- ACRP – Agriculture Climate Resilience Plan
- ANT – Actor Network Theory
- AHPC –Animal Health & Production Certificate
- ASDP – Agricultural Sector Development Programme
- ASDS – Agricultural Sector Development Strategy
- ASLMs – Agricultural Sector Leading Ministries
- AWF – Africa Wildlife Foundation
- API – Active Pharmaceutical Ingredient
- BEAC – British East Africa Company
- CBO – Community Based Organisation
- CSOP – Country Strategic Opportunities Programme
- DAP – Diploma in Animal Production
- DAP– Draft Animal Power
- DAH – Diploma in Animal Health
- DGA – Diploma in General Agriculture
- DSM – Dar Es Salaam
- DVO – District Veterinary Officer
- EASSy – Eastern Africa Submarine Cable System
- ESN (Electronic Serial Number)
- EWS – Early Warning Systems
- FAO – Food and Agriculture Organization of the United Nations
- FDI – Foreign Direct Investment
- FHI – Food for the Hungry International
- FSD – Food and Security Department

- FT – Farmer Training
- GDP – Gross Domestic Product
- GIS - Geographic Information System
- GLCRSP – Global Livestock Collaborative Research Support Program
- GPS – Global Positioning System
- ICTs – Information and Communication Technologies
- ICT4D - Information and Communication Technologies for Development
- IIME – International Institute for Environment
- IMEI – International Mobile Equipment Identity
- IMF – International Monetary Fund
- ITU – International Telecommunication Union
- ITW – Information Technologies World
- JAS – Joint Assistance Strategy
- LDC - Least Developed Countries
- LEWS – Livestock Early Warning System
- LGAs – Local Government Authorities
- LMO – Livestock Marketing Officer
- LINKS – Livestock Information Network and Knowledge System
- LITAs – Livestock Training Agency
- LSDP – Livestock Development Programme
- LSDS – Livestock Sector Development Strategy
- LSU – Livestock Units
- MALF Ministry of Agriculture, Livestock and Fisheries
- MEID Mobile Equipment Identifier
- MITM – Ministry of Industry Trade and Marketing

- MLD – Ministry of Livestock Development
- MLFD – Ministry of Livestock and Fisheries Development
- NARCO – National Ranching Company
- NGO – Non-Governmental Organisation
- NICTBB – National ICT Broadband Backbone
- NLMIS – National Livestock Marketing Information System
- NLP – National Livestock Policy
- NSGRP – National Strategy for Growth and Reduction of Poverty
- MDG – Millennium Development Goals
- PINGO – Pastoralists Indigenous Non-Governmental Organisation
- PLI – Pastoralist Livelihood Initiative
- RA – Resilience Approach
- SAGCO – Southern Agricultural Corridor of Tanzania
- SCOT – Social Construction of Technology
- SEACOM – East Africa Submarine Cable
- SIA – Sector Intervention Area
- SIM - Subscriber Identity Module
- SM - Sussex Manifesto
- SME – Small and Medium Enterprises
- SMS – Short Message Service
- SST – Social Shaping of Technology
- S&T – Science and Technologies Studies
- STS – Science and Technology Studies
- SWPa – Sector Wide Approach
- TAMU – Texas Agricultural & Mechnical University

- TCRA – Tanzanian Communication Regulatory Authority
- TSH – Tanzanian Shillings
- TDV 2025 – Tanzanian Development Vision 2025
- UCSAF - Universal Communication Service Access Fund
- UN – United Nations
- USAID – United States Agency for International Development
- VSF – Veterinaires Sans Frontiers - Suisse
- WB – World Bank
- WSIS – World Summit of Information Society
- WWW – World Wide Web

Chapter 1 - Introduction and story of the thesis

1.1. Aims of the study

This thesis aims to understand the implications of mobile phone adoption amongst two groups of livestock producers in two regions of Tanzania: the Maasai pastoralists of Arusha and the Wasukuma agro-pastoralists from the Lake Victoria Region. The study examines the rapid appropriation of mobile phones by these groups and the extent to which the mobile phone is changing how those livestock keepers organise their everyday lives and manage their herds, and in particular how they interact with the market supply chain. The Maasai are semi-nomads and practise extensive pastoralism, while the Wasukuma are more sedentary, undertaking a semi-intensive agro-pastoralist regime of activities. However, the scarcity of important resources such as grass, and increased difficulty in accessing land, are key constraints in both regions. These two regions present contrasting social, economic and political realities and thus represent distinct models on which to measure the effects of mobile communications on agrarian production. In those regions livestock production is key as a source of livelihood. These circumstances therefore determine the need for producers to make timely, autonomous and vital decisions regarding production and marketing processes; for instance, where to graze and how to choose markets in which to sell.

This thesis explores how mobile phones assist the Maasai and Wasukuma livestock producers in overcoming communication challenges and improving their livelihoods. I examine how the groups studied use portable telecommunication devices to negotiate with market players, coordinate the transport and delivery of cattle, and manage hazards and security issues, and micro-coordinate household affairs while undertaking long journeys with their livestock. This examination reveals how mobile phones allow local producers to manage critical moments of uncertainty with more flexibility and autonomy, while accessing critical information for production, marketing and delivery. For instance, it is now much simpler to change routes and find new destinations with greater accuracy, creating efficiencies in time and land management.

This helps producers to overcome challenges in accessing grazing lands, a rapidly escalating problem due to environmental pressures, political instability, and economic uncertainty, a trio of factors that contribute to increasing competition for land and resources, generating tension in both regions, and increasingly forcing the Maasai and Wasukuma producers to embrace new kinds of livelihood. These considerations were the starting point in framing the primary research question: *"To what extent is the appropriation of mobile phones changing pastoral lives, and how the mobile phone is changing the way pastoralists interact in the livestock market?"*

This question generated other important and specific sub-questions that will form the core of this research, which I have addressed by examining:

i) *what are the livelihood, and market changes;*

ii) *how are they affecting the activity and the way of life*;

iii) *who are the key actors within the livestock market*;

iv) *what roles are they playing*;

v) *how is the livestock market structured and maintained*;

vi) *what is the role of the mobile phone when supporting the interaction, and with what consequences*?

Therefore, my main research question seeks to understand and explain how the use of mobile devices by the two regional study groups influence social life, livestock production and trade activities. As this is an emergent phenomenon, I consider that an interpretivist approach is the most appropriate method for understanding people's choices in particular contexts and situations. This motivated me to select a qualitative methodology (ethnography) to guide the data collection (semi-structured interviews and participant observation) and analysis process (cross-sectional analysis), which has allowed me to contrast the adoption and use of the mobile technology in those two regions, and also to understand and explore some of the changes occurring in the Maasai and Wasukuma livestock producers' lives. This process has opened windows towards that changing social world and given me the opportunity to ground the interpretation on the user's experience.

1.2. Background to the study

Agriculture, in particular the livestock subsector, has been for decades an important sector contributing to the Tanzanian economy. Since Tanzania's independence[1], changes have been introduced within the agricultural sector aiming to increase productivity and national GDP. In the late 1990s the Tanzanian government renewed its efforts to restructure the agricultural sector as a whole and define a new strategy for reconfiguring the livestock market. This new strategy was supported by a broad vision (Tanzanian Development Vision 2025 - TDV), and was articulated in new policies, such as the National Livestock Policy of 2006, which were published in several operational documents.

That vision has generated a strategy, which is grounded in an ICT strategy to generate and disseminate more market information to assist agricultural producers and create a more profitable environment for producing or trading livestock, thereby improving those actors' livelihoods and helping to tackle negative factors inducing poverty. These considerations locate this research within the broad topic of Information and Communication Technologies for Development (ICT4D), where it is possible to find an extensive body of literature regarding the role of these technologies when promoting development. Nevertheless, I have some concerns regarding the idea of ICT4D, even though acknowledging that ICTs are changing the socio-economic panorama in developing countries, including in Africa, where the use of mobile phones is increasing and triggering many opportunities to reshape livelihood strategies. However, the conventional approach to ICT4D, which emerged in the aftermath of the controversy between modernization and dependency theorists, has shortcomings in terms of both adequacy of conceptualisation of the technology design/development challenge and as an effective strategy for intervention. I am critical of that perspective, namely the conservative perspective when it seems to lack more systematic, methodological and sophisticated strategies to operationalise the institutionalisation of Science and Technology (S&T) in Less Developed Countries (LDC). I suggest a more rigorous analysis regarding these anticipated benefits, mainly when taking into

[1] Tanzania become independent from the UK on the 9 December 1961

consideration the scarcity of some basic infrastructures to support the use of such technologies, which frequently drive ICT4D projects to an unsuccessful attempt to promote changes. Therefore I subscribe to the claim of Morales-Gómez & Melesse (1998, p. 367) when suggesting that earlier conceptualisations of ICT4D (e.g. 0.0 and 1.0) are "dangerously naïve and unrealistic" in the measures that they seek to overcome underdevelopment using a generic fix supported by transfer of new technologies into developing countries without having a deep understand of the context of their use.

This thesis accordingly seeks to contribute to the call for a new phase in ICT4D, which "will require new technologies, new approaches to innovation and implementation, new intellectual perspectives and, above all, a new view of the world's poor" (Heeks, 2009, p. 11). In particular it seeks to shift away from approaches (characterised by Heeks as ICT4D 0.0 and 1.0) which emphasised the development of dedicated technologies conceived and designed as a technical solution to problems in developing countries and instead to adopt a different perspective centred upon the user's needs (ICT4D 2.0). Drawing upon the social shaping of technology perspective (Williams and Edge 1996) my work emphasises the active role of intermediate and final users in selectively appropriating technologies and fitting them to their context and purposes. This approach (to which I should add conceptualisations around ICT4D 2.0), will, I contend, eventually help to overcome many challenges experienced by those living in developing countries, and facilitate the scaling of ICTs for the bottom of the pyramid (Foster & Heeks, 2013b).

The adoption and use of those technologies, notably of mobile telephony, has opened up many opportunities and helped to reshape a variety of activities and generated new forms of livelihood in poor countries. There is significant evidence that the use of mobile phones in developing countries is rapidly growing and is reshaping those countries, socio-economically and politically. It is contributing to the emergence of new micro strategies for people in the south, among them the livestock keepers in Tanzania. Nevertheless, evidence suggests that there is a pressing need to generate alternative strategies to help rural communities to overcome problems related to the lack of resources and infrastructure to better appropriate these technologies and gain improved access to markets - phenomena that this thesis seeks to shed light upon.

The rapid development of mobile communications technologies, and their roll-out in developing as well as developed economies, is bringing greatly improved facility to communicate – most strikingly in societies that previously lacked an extensive fixed line telephone service. This has allowed important changes to take place in pastoralist livelihoods and has led the Tanzanian government to adjust their strategy. This was initially supported by a vision that sought to modernize the livestock sector rooted in older conceptualisations of ICT4D. This approach revolved around the development of a dedicated solution (LINKS), designed by engineers as a "technical fix" (Williams, 2000, p. 9): a solution to some of the social problems besetting livestock producers, particularly regarding access to market information. While recognizing that Information and Communications Technologies can generate better conditions for the livestock supply chain, my data leads me to criticize this approach. My evidence suggests that neither group significantly adopted this apparently promising service, which had been implemented through a top-down approach. The pastoralist respondents point to various reasons for not appropriating the service, including the inconsistency of the sociotechnical infrastructure and the unreliability of the information disseminated, thus prejudicing their trust.

Therefore, the thesis aims to contribute to the debate on ICT4D by applying new concepts from science and technology studies and in particular the social shaping of technology perspective to better comprehend the appropriation of ICTs. This broadens understanding of strategies for exploiting technology to pursue development objectives. The decision to put into practice a top-down initiative in this critical and vital sector, based on a generic and imported solution, seems not to be fulfilling the goal of getting the livestock sub-sector to perform according to its fullest potential. The top-down approach seems to meet politico-administrative goals but fails to give an effective solution in practice to pastoralists' needs. The new service is portrayed as working well in official reports and statistics. However, a detailed empirical examination of what is taking place on the ground highlights the limited use of the system in practice and raises questions about its practical utility. This discussion opens up questions about how technology might best be fitted to the requirements of users. It highlights what Williams and Stewart (2005) describe as the "design fallacy" - the

difficulties of meeting user requirements in top-down prior design processes which often fail to address the real need of the users.

Interviews with the key techno-bureaucratic actors involved in this sociotechnical transformation revealed that they perceived this initiative in a top-down manner, in which the technology was perceived as a generic solution which would hit two targets with one (magic) bullet, i.e.: **i)** it would be possible to undertake implementation in a linear process and without needing to address local requirements, consequently **ii)** this technological fix would automatically solve one of the livestock sector problems, namely, lack of market information. I criticise such an approach not just for its resort to a linear model of innovation but also on pragmatic grounds, due to the inflexible development approach which increases difficulties and generates gaps in the implementation process. I articulate an alternative (bottom-up) approach to the development of ICT4D, not exclusively centred upon the prior design of technical fixes, but also addressing implementation and use, and the scope for the reconfiguration of the technology according to users' needs. My empirical case provides an opportunity to criticise existing approaches and also to contribute to the current debates about the ICT4D perspective.

Consequently, the research sheds light particularly upon the user experience, underlining the role played by those actors when appropriating mobile phone technology according to their needs and resources, and using it in innovative ways to overcome day to day hardships and obstacles. Furthermore, I bring into the discussion the fact that, given Tanzania's relatively low development levels, the incremental use of ICTs and the massive adoption of mobile phones in the day to day life of the Maasai pastoralists and the Wasukuma agro-pastoralists emerges as an unanticipated phenomenon.

Therefore, this study uses the concept of *appropriation* (Silverstone, Hirsch, & Morley, 1992; Williams et al., 2005) to understand "what individuals and groups make of and do with the objects they consume". In other words, this approach attempts to analyse "how objects are made meaningful in the process of their consumption." (Negus, Du Gay, Hall, Janes, & Mackay, 1997), and in particular "it provides a schema for understanding how contradictory requirements are reconciled, in particular the

tensions between global technological development and its local appropriation" (Williams, 2000, p. 14; Williams et al., 2005, p. 24) and how ICTs are integrated in those two regions according to the socio-technical infrastructures available, along with users' skills and willingness. This also links into the discussion about how the mobile phone has avoided the digital exclusion that has beset initiatives based on the internet linked personal computer. It contributes to a body of evidence about the mobile phone as a driver of change, and as a key component in innovation and development of micro-strategies to tackle poverty, and as a technological factor to be taken into consideration in the reconceptualization of discourses of development and modernity.

1.3. Motivation

This research began in 2011 when I approached the University of Edinburgh through the Science Technology and Innovation Studies subject group and the Centre of African Studies. At that time, I was in the beginning of the second year of my PhD in Communication Sciences in Portugal. The reasons that brought me to Edinburgh as a PhD visiting student were to enhance my theoretical background in Science and Technologies Studies, which seemed to me a good strategy for improving my capabilities as an ICT researcher, mainly by gaining deep insights into the Social Shaping of Technology approach. At that time, the research I was conducting at my previous university (Catholic University of Portugal) was related to the use of mobile phones among young people in Lisbon. I was trying to analyse how young people interact using text messages, and the new social dynamics this was generating. In parallel, I was exploring whether texting was becoming a hypothetical language of the 'new-new media'. This was a qualitative inquiry, theoretically grounded in semiotics and symbolic interactionism. These inquiries advanced my research interest in ICTs and how people interact with mobile devices. However, the idea of understanding those dynamics in a deeper and substantive manner, and how they are occurring in developing countries, was triggered in Edinburgh with a more solid understanding of the domestication and appropriation of technologies, which are key concepts of the social shaping of technology approach.

This research motivation emerged during my participation in a series of important seminars, where I had the opportunity to discuss the role of ICTs in promoting social development. This increased my intellectual curiosity and focused my research in ICT4D. Fundamental questions emerged: what is the role of mobile communications in developing countries? Is the mobile phone used as simply a gadget, or does it have the capacity to become a vital tool in supporting new livelihood activities? Discussing these issues led me to an unprecedented phenomenon occurring in Tanzania and Kenya, where members of the Maasai tribe were unexpectedly using the mobile phone in very innovative ways. This aroused my curiosity and challenged what I thought I knew about this tribe. It was not expected, at least for me, that the Maasai could deal with such technology so easily to improve their livelihoods, mainly when the region which they inhabit lacks key infrastructures to support and maintain the device in operating normally. From there I developed my research focus on mobile phone use among the Maasai pastoralists of Arusha, to which I added the Wasukuma agro-pastoralists, inhabiting the Lake Zone so that I could undertake a regional comparative analysis. When approaching the field for the first time in a pilot study, I understood that this phenomenon was broader that I thought initially, and involved more actors and resources, which required me to look at the big picture. In the field, I discovered that an ICT infrastructure/service had been put into place as the result of earlier thinking about ICT4D, the Livestock Information Network and Knowledge System (LINKS) which emerged to address markets needs and attempt to improve trading practices. Therefore, looking at the market structure also became a research issue, though it was not initially conceived as the starting point for the research.

As such, the thesis aims to contribute to knowledge in four ways: **1)** it highlights important aspects of the mobile phone adoption by the Maasai and Wasukuma pastoralists, emphasizing how the appropriation of such a device has given them the opportunity to reshape some important aspects of the livestock production and marketing, and providing the opportunity to address something that had not been much discussed. **2)** The study findings suggest an extension of the "*appropriation*" (Williams et al., 2005) conceptualisation by adding the possibility of a *spectrum* from *shallow* to *extended* appropriation according to user role and the context of use. I further observe that the mobile phone use did not disrupt some conservative practices

and trade customs amongst the Maasai, and it has reinforced the innovative behaviour of the Wasukuma. **3)** In the case presented, it has shown how the concept of trust, which is key in market dynamics and trade relations, has been reshaped, and imposed a new conduct resorting from the ubiquitous surveillance that it enables. **4)** I present a model which I believe opens up a space for a generic understanding of the technical change, where the technical fix is socially shaped upon what works and is fulfilled through an effective social learning of the technology process.

1.4. Thesis structure

The structure of the thesis is comprised of 10 chapters including this first introductory chapter. Chapter 2 will introduce the research strategy (2.2) and methodology (2.3.) of this investigation, including data collection (2.3.1) and data analysis (2.3.2). The last two sections will proceed with a short reflection (2.4) and the concluding remarks of the chapter (2.5). In chapter 3 I discuss the context of this thesis, presenting the socio-economic profiles of Arusha and the Lake Zone, including the contrasting approaches to livestock production. In chapter 4 I review literature on Technology Studies and introduce my analytical framework, seeking to understand the relationship between technology and society. This lays the groundwork for introducing the analytical framework, specifically the theoretical concept (Appropriation) supporting this investigation. I highlight the shortcomings of prevalent technological determinist discourses and related linear models of innovation and development (4.2.) and the critiques of those approaches that underpinned the so called new sociology of technology (4.2.1.). I then introduce an alternative approach to understanding the society-technology relationship, the Social Shaping of Technology approach which emphasizes choices of design and implementation to stress the representation of the users (4.3.). Section 4.4. introduces discourses of development, highlighting recent debates on ICT4D programme (4.5.). The last three sections of chapter will illustrate the relation between ICTs and the capacity to build resilience (4.5.3.). This will be followed by the operationalisation of my analytical framework (4.6.). The last section (4.7.) will proceed with the concluding remarks.

Chapter 5 reviews specific literature regarding the importance of the livestock sector in Tanzania. The chapter is comprised of four sections. After the introduction (5.1.) I draw the background in order to develop understanding of the importance of the Tanzanian livestock sector (5.1.1.) This is followed by some ideas regarding the development of the sector (5.2.), and how ICTs are being used to enhance agriculture and livestock activities (5.2.1.) 5.3. will conclude the chapter.

Chapters 6, 7, 8 and 9 constitute the bulk of the empirical material of this thesis. Chapter 6 analyses the evolution of the government-led LINKS system, using interviews and data from discussions with relevant government actors, and supported with official documents collected in two key ministries (Livestock, and Trade & Marketing). The aim is to build a narrative of LINKS as an emergent ICT service (6.2.) in East Africa for supporting the livestock trade. I shall describe its evolution from a research project to a formal service in three countries in East Africa (6.3.) and describe the roll out process in Tanzania (6.4.). Section 6.5. presents some reasons preventing the LINKS uptake.

As described earlier, this research is grounded in a comparative regional analysis of two key livestock production regions: Arusha and the Lake Zone. That is the aim of chapter 7, which is divided in two parts. In structuring the chapter, my aim is to use a comparative methodology for the two regions, albeit that the differing methods of livestock management result in different volumes of information being available for analysis. The first half of the chapter describes processes in Arusha (7.2.) and the second focuses on those found in the Lake Zone (7.3.). Here I discuss issues such as the exigencies of pastoral herd management (7.2.1 & 7.3.1.), market dynamics and approaching strategies (7.2.2. & 7.3.2) and how movements can impact the herd (7.2.3. & 7.3.3.). In 7.4. I will summarise the two parts of the chapter.

The same strategy of proportion is attempted in the structure of chapter 8, and again I found the same constraints: some phenomena have less or more implications in one or the other region. Still, the aim of chapter 8 is to discuss who are the producers and how are they adopting the mobile phone to tackle some of the most frequent constraints affecting production and marketing of livestock. Here I analyse and present matters such as the use of mobiles phones to manage risk (8.2.1. & 8.3.1), to coordinate

movements and transportation (8.2.2. & 8.3.2.), and to negotiate market terms (8.2.3 & 8.3.3). Rather than limit analyses of the impact of mobile phone use on livestock activity, I extend the study to consider its effects on everyday social life (8.2.4. & 8.3.4.), where I am able to pinpoint issues of micro coordination of the family and household. As such, I would say that these two chapters (7 and 8) represent a substantial part of the comparison between the two regions. Section 8.4. presents my reflection and the 8.5. my concluding remarks.

Chapter 9 elaborates on chapter 8, more particularly around mobile phone use in the regional markets. I conclude the story of LINKS initiated in chapter 6 and show how mobile devices are reshaping market operations and how this is challenging and generating opportunities for LINKS (9.2.), and therefore framing the future of the livestock sector (9.3.). I then wrap up the chapter with the concluding remarks in section 9.4. Chapter 10 summarises my findings and presents the thesis contributions and conclusion.

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Chapter 2 – Research Strategy and processes of data collection and data analysis

2.1. Introduction and research aims

This chapter introduces the study methodological options and choices and is organized as follows: in this section (2.1.) I present the introduction, which is followed by the research strategy (2.2.) that underlines the research choices and design. The third section (2.3.) will shed light on the processes of data collection and analysis, and the penultimate subsection (2.3.2.) stresses the strategy used to break and polish the data, including coding all the material, and to thematise topics to be analysed, which later would be transformed in early drafts of key empirical chapters. The last section (2.4.) presents my reflection and 2.5. a summary of the main ideas presented in this chapter.

This study is grounded in a comparative analysis methodology which seeks to answer my research questions. It sets a comparison of the livestock production and marketing between two relevant production regions in Tanzania where data was collected amongst two groups of livestock producers, the Maasai and the Wasukuma, the former being a semi-nomadic tribe inhabiting Arusha region, and the latter a more sedentary tribe living on the shores of Lake Victoria, specifically in the Mwanza and Shinyanga regions. The aim is to examine the embrace of mobile phones by those two groups of producers. I undertook an ethnographic journey, collecting data in different regions and in a significant number of livestock markets across the country. Actors such as livestock producers, market officers, members of the local and central governments, technicians working in public services and ministries, as well as experts working in academia were interviewed in order to gather data to help address the research questions. The fieldwork was conducted in two phases (pilot study and then extensive fieldwork) capturing the frames of the reality. Fifty-seven interviews were carried out in regions such as Iringa (southern), Dodoma (central), Arusha (northern), Mwanza, Shinyanga and Maswa (Lake Zone), and Morogoro and Dar es Salaam (coastal) in order to compare livelihoods and livestock dynamics, as per the table on page 24 and in Appendix 4.

2.2. Research Strategy

In order to understand social life regarding social actors' "meanings and motives" (Blaikie, 2010, p. 85) my option was to ground the research in an abductive research strategy, since it involves gathering explanations that derive from "social actor's language […] and then deriving from them categories and concepts that can form the basis of an understanding of the problem at hand" (idem, p. 89). This will allow me to observe the reality from a substantive perspective, anchoring the inquiry in relevant theoretical concepts from Technology Studies, and fostering the concept of *appropriation* (Silverstone;, Hirsch, & Morley, 1992; Williams et al., 2005). I thought that this would increase opportunities to guide my reasoning, favouring conditions for understanding the interplay between technology and society.

As this is a qualitative inquiry, and supported by a constructivist tradition, it requires one to interpret the social world not as an external phenomenon, or a single and objective reality, but rather, to perceive the social world as being a form of thought in which we human beings take a relevant role. This suggests choosing Interpretivism as the ontological way of observing social reality, taking into consideration that this will allow me to move "between everyday concepts and meanings" considering that "social reality is made up of shared interpretations that social actors produce and reproduce as they go about their everyday lives" (Blaikie, 2010, p. 94). This should enable the use of adequate lenses to look at the "ongoing social contexts in which cultural meanings are being produced and how the production of culture matters in those contexts" (Geertz [1973], 2008, p. 29). Therefore positioning myself at an abductive stance. This seems to me the suitable research strategy to inquiry about that reality, namely when this research is supported largely in a '**what'** question.

However, understanding and presenting what lies beyond our reach is only possible through data emerging from the main actors' experiences. Therefore, embracing a qualitative approach allowed me to gain a privileged angle of observation and to scrutinise the phenomena from the users' perspective, consequently gaining access to relevant factors that would not be possible through embracing a more quantitative and/or macro-level approach, neither of which would allow to move further and beyond the top-down perspective and generate an account closer to what a large-scale

study would produce. As such, my strategy, in embedding this study in a more micro-level stance, has enabled me to gain access to some important dynamics amongst those actors, and to make an intensive observation and to study the mobile phone uptake by the Maasai and Wasukuma livestock producers, even though there are risks inherent to explore this phenomena at micro-level dimension. For instance, this may disable a more encompassing understanding of the livestock market. However, because this is not a sociology of markets, rather it is about how individuals adopt a particular technology, I believe this strategy will enable me to gain access to the social reality I seek to understand.

2.2.1. The overarching research question

The overarching research question asks; "*to what extent is the appropriation of mobile phones changing pastoral lives, and how is the mobile phone changing the way pastoralists interact in the livestock market?"* and it constitutes the core concern of this research. I believe that it is important to answer this question in all its variants once it will help me, in a theoretical perspective, to conceptualise technology appropriation as well as to gain insight into matters surrounding the policy making process, and into the implementation of strategies aiming at a given sociotechnical change. In answering the above question, I will have the chance to explore which social and technological factors are lying underneath the adoption of such technologies, highlighting the ease of appropriation of the generic mobile technology across cultural boundaries and identifying different forms of technology adoption according to the context, where users process meaningful interpretation and negotiate technology meaning and practice, which facilitate the adoption. This approach will me allow to gain understanding of the user's perspective and thereby generate conditions for investigating how the appropriation and integration of the mobile phone in the social life of the pastoralists are being done, and how this is changing their livelihoods. As such, the findings gave me the basis for sustaining a new rationale regarding dynamics between the top-down and bottom-up perspectives of policy making and implementation processes, moving beyond and above the conservative linear perspective (which I will call the top-down 1.0), and grounded in a more inclusive standpoint, highlighting "the importance of practical and local activity and knowledge" (Williams et al., 2005 p.8), which I will describe as the bottom-up 2.0. This new rationale suggests placing more emphasis on the local users and local context (similarly to Heeks ICT4D 2.0 approach) and less on generic and global fixes, emphasizing the interactive learning process which encompasses a broader spectrum of appropriation, redefining the generic fixed "open-ness to re-negotiation by local actors" (Williams et al., 2005, p12) opening a new stage in the discourse of modernity. Therefore, I choose the concept of *appropriation* as the research framework, to understanding how artefacts work, in "the existing, heterogeneous networks of machines, systems, routines, and culture" (Sørensen, 1996, p.6).

2.2.2. Research Design: interregional comparative analysis of the socioeconomic dynamics of livestock sector in Arusha and the Lake Zone

The decision to design this study as an interregional comparative analysis of two regions in one country emerged as the most prominent recommendation of the members of the transition panel, which changed my initial, and probably to ambitious plan, to compare two countries (Tanzania and Kenya) where the livestock sector plays an important role for the contribution of agricultural sector to the GDP. The panel members recommended that I focus the study in just one of those two countries but optionally to undertake a regional comparative analysis. After assimilating those recommendations, I recognised that due to the idiosyncrasies of both of the countries, namely the distances to travel between the sites to visit and collected data, it would be hard, if not almost impossible, to complete the fieldwork within the time frame available. Therefore, I had to rescope my research, and review my research questions. This led to the implementation of a different research strategy, and I chose Tanzania as the country to be studied, which is appealing for an interregional comparative analysis of the socioeconomic dynamics of livestock sector, and specifically choosing Arusha and the Lake Zone as the regions to be compared.

The decision was not difficult, mainly because Kenya was experiencing terrorist activity on the part of the Somali terrorist group Al-Shabaab, which would raise concerns for research ethics approval. However, the chosen country of study – Tanzania – is vast and with different socioeconomic/political variances, the most relevant being the gap between urban, peri-urban and rural areas, generating implications for the process of data collection. This forced me into long travels from one region to another, which required the permanent adjustment of the fieldwork strategy and allocation of resources. Another issue was the emphasis placed on markets, which was not an immediate priority from the outset, due to the fact that those pastoralists were using mobile phones to tackle livelihood constraints. When I started to carry out the research, namely when undertaking the pilot study, I saw that the mobile was being used throughout the lifecycle of the pastoralism and agro-pastoralism. The device seemed to have significance in relation to navigating the

market, where the government has provided a platform which emerged somehow in competition with predecessors. As such, the market becomes an issue in the course of doing research.

The research process itself brought significant outcomes and gave opportunity to obtain a good perception of the political and socio-economic context in which the livestock producers are immersed. The Maasai and Wasukuma were selected since they are two important groups of livestock producers that have embraced mobile phones for tackling some of the key issues affecting both production and marketing processes, in two of the most important regions (Arusha and Lake Zone) for cattle production. By selecting Arusha and the Lake Zone regions, my goal was to investigate two contrasting systems of production and to collect information on contrasting livelihood strategies and factors assisting production and marketing, and therefore to analyse dichotomies and factors facilitating or constraining the adoption and use of mobile phone in livestock, and how those two aspects interplay with the livelihood of those actors.

2.3. Process of data collection and data analysis

2.3.1. Data collection

The need to gather data and structure information in order to answer the research questions in a logical way elicited some methodological issues. The most significant was the strategy to coherently consolidate the data, in order to build the narrative, which "involved a process of labelling, organising, and interpreting data with reference to a set of 'codes', 'categories', or 'themes'" (Ritchie et al., 2013, p. 272). Therefore, data were collected taking into consideration the need to produce a thick description of the phenomena under analysis. In this particular, the above author (2013, p. 268) suggests "to provide sufficient detail of the original observations", which does not necessarily mean a large extension of data, rather, that researchers should reproduce as thorough as possible what they have seen. In my case this has required me to cover as much as possible of the country, incorporating regions where livestock keeping, and livestock trade are significant, but bearing in mind that I would not be able to cover

the country fully. In this aspect, conducting the pilot study was critical, since it gave me the opportunity to gain a more accurate insight into issues affecting the Tanzanian livestock market. During that phase, I conducted five pilot interviews, aiming to test my strategy, and to ensure that the research questions were workable and that nothing was missing, also allowing me to conclude that I would need more than one interpreter to help me deal with issues of language barriers. This would also prevent me of losing content during the translation and consequently decrease conditions to prevent bias. The results were very satisfactory and encouraging, and the first round of answers gave insights into the research that I intended to carry out, confirming the initial perception: the mobile phone was being substantially used in livestock activity. Observation done in two markets visited during this stage gave me the opportunity to see key actors (producers and middlemen) interacting in order to trade cattle, and it was noticeable that there was frequent recourse to mobile phone use during the negotiation and before the deal being sealed.

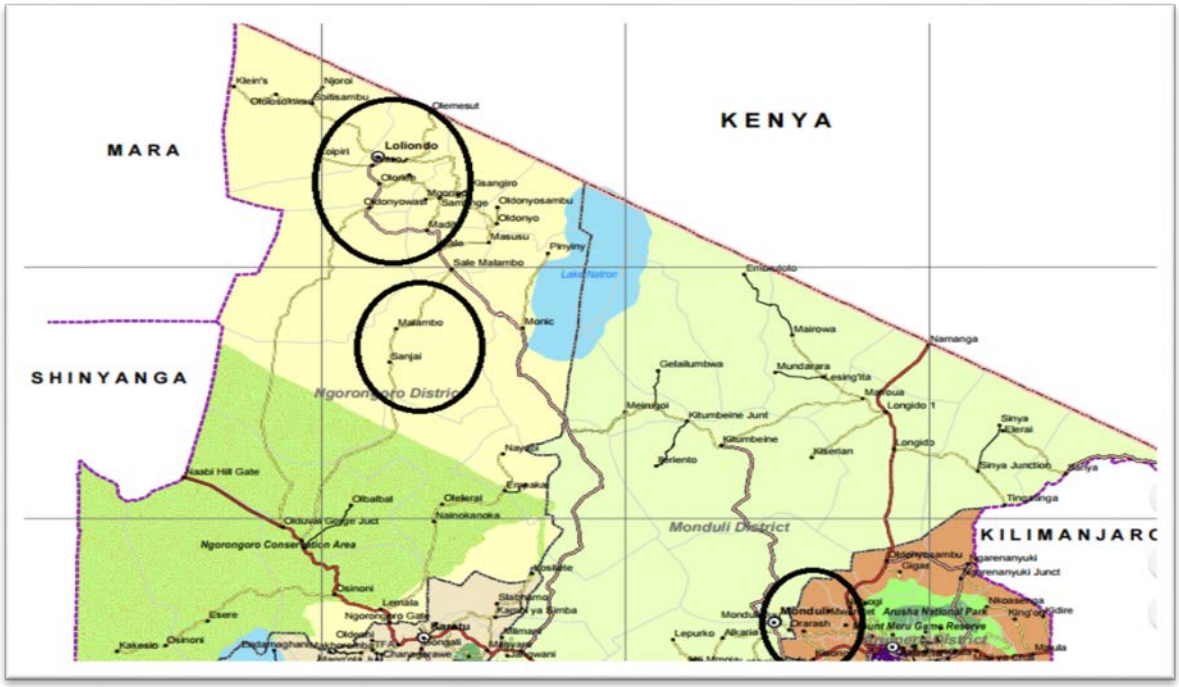


Figure 1: Map of Arusha: circulated are the 3 research spots (Loliondo, Sale and Monduli) where the data were collected

Due to the intrinsic value of the data collected in the pilot study, I decided to incorporate some of the material collected in the thesis narrative, which I will present in the empirical section, i.e. chapter 6 onwards.

The second phase of data collection, i.e. the extended fieldwork, began in early June 2014, and continued over a period of approximately 3 months. The data were collected in some of the most important livestock markets across the country, and not only in the Arusha and Lake regions, trying to capture key elements of the social reality, which was only possible through the lens of the social actors being investigated, mainly when observing their daily activities, and seeking to understand the process of change and technology adoption supported in the users' visions and experiences.

Figure 2: Map of Lake Zone: circulated are the 3 research spots (Mwanza, Shinyanga and Maswa) where the data were collected

This suggests the use of a qualitative inquiry in order to understand practices and to interpret those actors' actions regarding strategies used to overcome hardship and negative factors affecting production and marketing cycles, which lead them to incorporate the mobile phone into their day to day activities. By grounding this inquiry under a qualitative perspective, I hope to be able to gain understanding regarding how the artefact is perceived across those two regions, which, as I have said, are contrasting realities in livestock production and marketing dynamics.

2.3.1.1. *First source of information: participant observation and semi-structured interviews*

It was necessary to set a plan regarding the regions and markets to visit, and to schedule as many interviews as possible. Those were the reasons why I decided to approach first the policy players and some of the intermediaries' organisations so that I could frame the issue from the inside perspective, anticipating challenges to be overcome, identifying potential collaborators and other gatekeepers. The information collected gave me the chance, in a second stage, to focus down on the pastoralists and gather their perspective regarding the sociotechnical transformation. I then drew up a plan with the support of key informants in the Ministry of Industry, Trade and Marketing (MITM). It is relevant to state that all the information collected constituted pieces of the big jigsaw puzzle and helped to build the big picture, which had started to take shape even before the field work started, with the support of my supervisors, internal advisers and other relevant collaborators both from my department and the Centre of African Studies. Another important aspect to underline was the need to request permission to conduct this research. This was done during the first phase of the field work, when I approached the Commission for Science and Technology (COSTECH) in Tanzania and formulated the request. The permission took a few months and after that I needed to request permission to the emigration service of Tanzania to issue the research visa, to legitimately conduct the fieldwork.

Subsequently, data was collected in two different stages (pilot study and extended fieldwork) of this research and in several regions, however for this study I will be using just the information collected in Arusha and the Lake Zone (see maps on the previous page), which are two of the most prominent livestock production regions and represent a dichotomy between the regions, relevant in what concerns methods and infrastructures. In both stages of data collection, I used ethnography as the main method to gather information once this will give me opportunity to interpret "the ways other people understand their world" (Geertz [1973] 2008, p. 29), using semi-structured interviews[2] to capture important frames of that social reality and collect data to address the research questions, producing what the above author suggests to be a

[2] Constructed from a set of heuristics that helped me prepare the fieldwork (appendices 1, 2, and 3)

thick description of the social reality being investigated, i.e. " a stratified hierarchy of meaningful structures (Geertz [1973], 2008, p. 32), which suggests the use of some tools emerging from Grounded Theory, as I will explain in the next section.

As said above, I collected data in two stages. In the first, I made five presentations[3], introducing this research. I had one informal conversation with a master's student who had conducted research on mobile phone use amongst the Maasai. I did five interviews, collecting data in two livestock markets – Monduli and Weruweru – situated on the outskirts of Arusha city. I visited and also collected data in two non-governmental organisations, the Women's Pastoralists Council (WPC) and the Pastoralists Indigenous Non-Governmental Organisation (PINGO), and in a public institution, the Ministry of Industry, Trade and Marketing (MITM). This helped to gain a sense of the main issues affecting the livestock sector at large, and approach key actors and prepare the second phase of this research, the extended fieldwork. In this stage, I had the support of a wide range of players, from technicians and administrative staff working in public institutions, to a vast number of key players within the livestock market structure. I interviewed key informants from private and public services and academic institutions. Observations and informal discussion took place with other players within and outwith the livestock sector, aiming to understand some collateral phenomena that could influence the way the livestock sectors behave. Notwithstanding the table showing the scheduled interviews, some informal conversations, which emerged in the sequence of the snowball technique used to find complementary informants, were not recorded but later put in the filed journal as a direct result of the research observation.

As noted, the interviews were carried out mainly in the two contrasting regions (Arusha and the Lake Zone), nevertheless I extended the data collection process as far as was possible in order to build a holistic understanding of the livestock sector and marketing system in Tanzania. This took me through a rich fieldwork experience during several months, observing, learning and getting immersed in the social world of those livestock keepers. During the second phase, a total of fifty-seven interviews (please see Table 1 and Appendix 4) were collected, contacting key actors in the

[3] Presentations were made to the Science, Technology and Innovation - Policy Research Organization (STIPRO), the Commission for Science and Technology – Tanzania (COSTECH), the University of Dar es Salaam, Computer Centre, the Livestock Training Agency (LITA) in Arusha – and in the Pastoralists Indigenous Non-Governmental Organisations (PINGOS)

Ministry of Industry, Trade and Marketing, the Ministry of Livestock Infrastructure, Development and Marketing, the Ministry of Agriculture, Food Security and Cooperatives, The University of Dar es Salaam, The Nelson Mandela East African Institute for Science and Technology, the Tanzania Communication Regulatory Authority, and Vodacom Tanzania. I interviewed several market managers, livestock market officers, LINKS monitors, one Zoo Sanitarian Inspector, and one Ward Executive Officer, as well as the Chairman of Mwanza City Butcheries. Amongst the main actors, I interviewed a significant number of livestock keepers, one Laiboni[4], trader, a lorry man, middlemen and a few individuals undertaking parallel business within the livestock market, such as mobile phone repairers.

[4] The Laiboni is the spiritual leader of each of the clan and is a much respected personality in the Maasai hierarchy. In this case I spoke with the Laiboni of Maaloni Village, Loliondo, Ngorongoro division, Arusha.

INTERVIEWS				Total
Sector	Organisation	Local	Role	3
Techno-administrative	Ministry of Industry Trade and marketing	DSM	LINKS coordinator	
Techno-administrative	Ministry of Industry Trade and marketing	DSM	Assistant director Department of Marketing, Information and Research	
Techno-administrative	Ministry of Agriculture, Food Security and Cooperative	DSM	Technical (dissemination)	
Policy Making	Ministry of Livestock, Infrastructure, Development, and Marketing	DSM	Political	2
Policy making/Implementation	Local Government	Lake Zone	Political	
Academia	University of Dar es Salam	DSM	Technical support	2
Academia	Nelson Mandela Institute for Science and Technology	Arusha	Research	
Regulation	Tanzania Communication Regulatory Authority	DSM and Lake Zone	Regulatory	1
Technical Institute	Livestock Training Agency Tenguru	Arusha	Research/Training	1
Private sector	Vodacom Tanzania	DSM	Telecommunication Service provider	1
Livestock sector	Markets and other structures supporting the livestock chain	Arusha, Morogoro Dodoma, Iringa and Lake Zone	Operational	8
Livestock sector	Producers and traders	Arusha, Morogoro Dodoma, Iringa and Lake Zone	Production and trade	39

Table 1 - Summary of the interviews done during the fieldwork

2.3.1.2. Complementary sources of information

The first set of interviews were done mainly in Dar es Salaam and they aimed to build an understanding of the political and techno-administrative situation of the livestock market, for instance the interviews carried out in the Ministry of Industry, Trade and Marketing, where I had the opportunity to contact key informants, such as Mr. John Chassama, the LINKS coordinator, and Mr Manumbu, the assistant director of the marketing and research department, provided opportunity to gather relevant information and documents, and to execute a detailed chronogram of the regions and markets to be visited. Those interviews also provided the opportunity to identify and select potential collaborators/research assistants and people to contact in the face of any difficulty or if help was needed. This was planned in a sequence of meetings held to operationalise the fieldwork, therefore avoiding the "rude surprise" (Feldman, Bell, & Berger, 2004, p. vii) of not having access to those sources of information. In this case "[r]esearchers may desire access to conduct interviews with individuals who are part of a single organization – congress people, Supreme Court justices and clerks, hospitals board members, or those in similar organizational context who do not necessarily belong to the same organization or group but are linked" (idem, p. 75).

With the support of those informants I had the chance to make contact with some LINKS market monitors. It was also during this stage of the fieldwork that I did relevant administrative work regarding the places and people to contact in the field. Letters were issued and sent by fax to where requested, seeking permission to collect data. During the data collection process, I had permanent contact with those people in Dar es Salaam, which ensured the liaison with the market managers (most of them became my research assistants/interpreters). The fieldwork was facilitated by the cooperation of those actors: they opened doors and gave me the basic tools and knowledge regarding the state-of-art of the sector.

Another fundamental input of the preparatory work was a valuable tip given by John Chassama, who suggested contacting another internal informant in the same Ministry, even knowing that this person would critically analyse him and his work. This person was a key actor involved in the first stage of LINKS implementation and was currently

playing an important role within the department of Marketing, Research and Information in that ministry. This important actor was the marketing assistant director, who would give me complementary information regarding the implementation of LINKS and its predecessor (running upon the Symfony Web Framework).

2.3.2. Data analysis

2.3.2.1. Interviews and Transcription process

Analysis of the fifty-seven interviews was required in order to explain mobile phone adoption by those two groups of livestock producers and understand the livestock production and marketing dynamics. Nevertheless, and before embarking on the data analysis process it was necessary to transcribe all the interviews recorded. This was a very time-consuming process given that some of the interviews were extremely long and required translation from English to Swahili and vice versa, i.e. the process frequently needed two interpreters (see page 33) and comprised four steps; **i**) put the question in English to the interpreter/research assistant, **ii**) interpreter puts the question in Swahili to the person being interviewed and **iii)** receives an answer in Swahili from the person being interviewed and then **iv)** translation and response to me in English by the interpreters, who would check between them the accuracy of the translated response. For instance, in some cases I had to reformulate my question to make it clear, because in some circumstances the interviewee's facial expressions and the body language expressed that the question was not being understood clearly. With time and familiarisation with the Swahili language I was able to intervene more frequently, ensuring that my question would be always clear and well understood. This was the methodology for all the interviews made to non-English speakers, and it has revealed a critical decision since very often those interpreters were able to draw my attention to relevant details that I would not have been able to discover by myself. This was only possible because almost all those livestock market officers, persons recommended, and the ones I met by chance when undertaking different tasks within the livestock market, become very familiar with the research goals, and my particular circumstances (not being able to speak Swahili and travelling alone).

With regards to the transcription process, the fifty-seven interviews were transcribed by me verbatim. This was a rich process, where I was able to gain a real and deep sense of the data and the most important topics to be discussed in the empirical chapters. In some transcriptions, I had to make use of specific software to better manage the issue of speech speed, and in those cases, I used the Express Scribe software, which has a particular feature that allows the speed of the speech to be increased or decreased and therefore for better comprehension of some sentences or words, ensuring accurate transcription.

2.3.2.2. Triangulating the sources of information to ensure reliability and validity

In the field and during the data collection I was persistent in obtaining different perspectives and angles of the same phenomena, i.e. contrasting world visions of the same phenomena between contrasting realities and/or actors; for instance in what concerns trade, I juxtaposed the middlemen against producers, and in what concerns the ongoing changes at the livestock industry I contrasted the marketing officer (public arena) against the trader (private arena), and in what concerns the direct outcome of the livestock activity (production and marketing) I put the pastoralist in contrast to the agro-pastoralist. This allowed me to execute some of the procedures inherent to triangulation in order to converge reliability and validity, namely by i) contrasting opposite actors ii) in both public and private arena, regarding the same topic, and iii) in parallel analysing relevant policy and strategy documents and other documents regarding the livestock sector at large. Those three angles of observation allowed me to consistently and constantly (Kirk & Miller, 1986) “establish the chain of evidence” (Yin, 1994, p. 33), a matter of important relevance for the nature of a qualitative inquiry. This was a meticulous and coherent approach to data collection and to capturing the meaning of the participants, mainly when ensuring that the results of the participant observation would have referents as to where to be mirrored, viz. with evidence emerging from alternative process of data collection. Consequently, I can claim to have created stable ground, mainly when following Silverman (2013, p. 133) and Flick (2009, p. 444), recommendations when suggesting “the use of different data sources […] between time, space, and persons, [i.e.] studying phenomena at different

dates and places and from different persons", thus safeguarding robustness and stability evidence produced and making inferential generalisation possible, supported in the reliability and validity of the findings, as I will demonstrate in the empirical section.

2.3.2.3. *Coding and theming the data*

Coding and theming the data was done in two stages, one more analogical, and the other assisted by specific software for qualitative data analysis. In the analogical stage, I had to read all the interviews, and using word processing software I coloured line by line important speech excerpts of the fifty-seven interviews and "moving back and forth between our own data" (Mason, 2002, p. 180) which is a typical procedure when one adopt an abductive approach. This was another very time consuming task, although, as has happened with the transcriptions, this would later be revealed as being very important, once I managed to consolidate and gain a thorough insight of the data

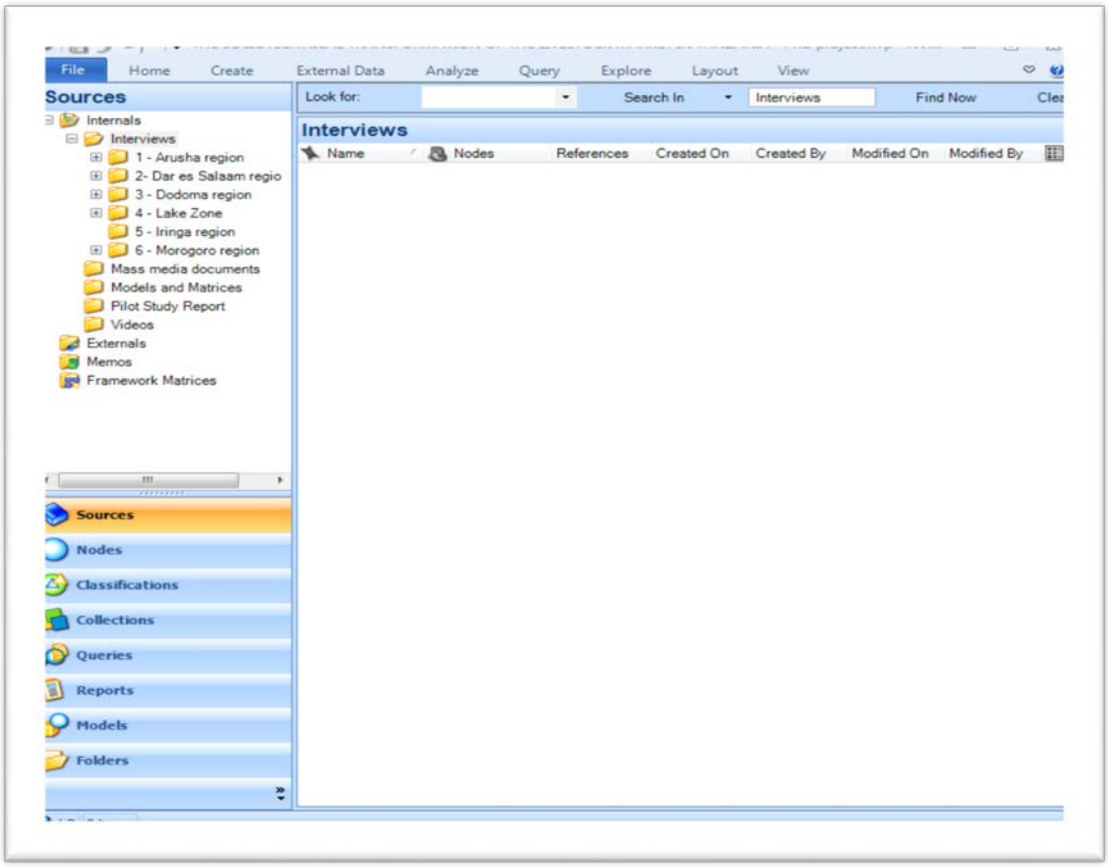


Figure 3: Main categories: the six regions selected in the initial stage of this study (Source NVivo project)

in hand, which suggested the creation of categories "according to the type of thing being referenced, and group then according to key similarities and differences" (Gibbs, 2007, *cf* in Ritchie et al., 2013, p. 272), which required the use of complementary software[5]. The result of this decision was the creation of 6 regions to be scrutinised: Arusha, Dar es Salaam, Dodoma, Lake Zone, Iringa and Morogoro (see fig. 3 on the previous page). Following Van de Vijver & Leung (1997) methodology for comparative analyses of "different ethnic groups from a single country", I attempted to promote what they define to be the "scalar equivalence, or full score comparability". Nevertheless, having in mind that "it is uncommon, however, to find evidence to substantiate the claimed equivalence" (idem, p.144).

Using a cross-sectional analysis[6], which is also suggested as adequate for drawing comparisons (Mason, 2002, p. 152), I started the second stage of data analysis. I managed to retrieve chunks of data from the raw material and split that information according to the regions I had visited. The reason for this strategy was to allocate the material according to an explanatory logic and obtain a systematic view of my data and build an idea of the scope and coverage. This strategy allowed me to create a certain distance from superficial memory and "gain a more measured view of the whole" (J Mason, 2002, p. 152), therefore ensuring to a great extent the validity of my explanations, which serves "the ultimate goal of qualitative research" (Ritchie et al., 2013, p. 274).

The next stage was to subdivide the information by subcategories as advised by Strauss & Corbin (1998, pp. 114-115). This screening process gave the chance to start organizing information and to map the arena around livestock market structure and dynamics. This would allow for the creation of themes for each of the empirical chapters later on, and consistently thematise the data and generate evidence supported in patterns and recurrences in order to better explain those actors' roles and behaviour. Those themes covered topics such as when approaching the livestock market using a mobile phone, gaining perception about how the mobile phone is used when a decision

[5] My choice was the NVivo 10. This is one of the best-known computer-assisted qualitative data analysis software (CAQDAS)

[6] This is suggested as adequate for contrasting two samples or things being compared (Ritchie et al., 2013, p. 273)

is needed about whether to sell or buy cattle, and where and at what price (see chapters 8 & 9), and how this is contributing, or not, in improving livelihood activities and coping with hardship (chapter 7). After splitting the data, I was able to build a set of subcategories (see in the next page), and work in a more manoeuvrable manner on the fifty-seven interviews.

2.3.2.4. Building subcategories

This strategy disentangled the possibility of cross-referencing and comparing, by similitude or dissimilitude, the livestock activity in those regions. As such, I generated three subcategories: Actors & Agents; Sociotechnical Arena[7]; and Reflections, which, according to Ritchie et al. (2013, p. 272), would propitiate the labelling of the data under specific themes and code all of the interviews. The first option fell over Dar es Salaam. For this region, there was a total number of 11 interviews, most of them being exploratory interviews and aiming to collect information to set up the background information regarding the big picture, not only with regards to the policy making arena,

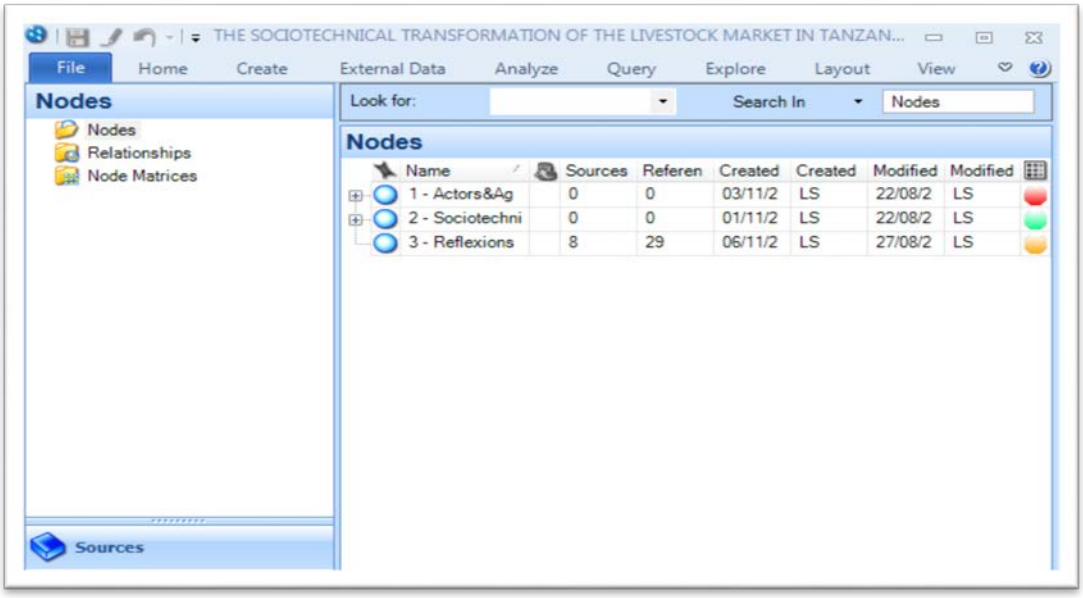


Figure 4: Main nodes: 1) Actors&Agents, 2) Sociotechnical Arena, 3) Reflections

[7] *"This is a relevant concept in STS, and in the work developed by Jorgensen and Sorensen (Jorgensen, U., & Sorensen, O. H. (1999). Arenas of development-a space populated by actor-worlds, artefacts, and surprises. Technology Analysis & Strategic Management, 11(3), 409-429) and by other scholars affiliated to the so called "new sociology of technology" e.g. SCOT and ANT. However, and because I was not looking at the development of LINKS, but yes to the appropriation of mobile phones by those two groups of actors I decided, in agreement with my supervisors, not to explore further those concepts. Nevertheless, LINKS can be perceived as a sociotechnical arena and therefore studied using those concepts as the analytical framework."*

but also in what concerns the livestock sector activity, since Dar es Salaam is the end of the chain and is the destination for the majority of the cattle produced in those regions. The second option fell over Arusha region, where I had a total of 8 interviews, and the third the Lake Zone, with a total of 15 interviews. The data from Dodoma, Morogoro and Iringa were coded just for context, since the cross-sectional analysis was done exclusively between Arusha and the Lake Zone.

2.3.2.5. The analytical journey

The coding process was a complex task, mainly because after indexing and sorting it was necessary to refine the initial structure and create categories and subcategories. I soon realized that it was also necessary to narrow down to specific situations (themes/analytical codes) so that it would be possible to compress the empirical material on three particular actions: i***)*** how they manage herds, ii) how they manage market issues by using the mobile phone, mainly in what respect in the access to information to support the decision-making process; and iii) how they manage household issues. Here it is important to mention that those 3 subcategories emerged from the first round of coding (manual coding process), which gave a clear picture of

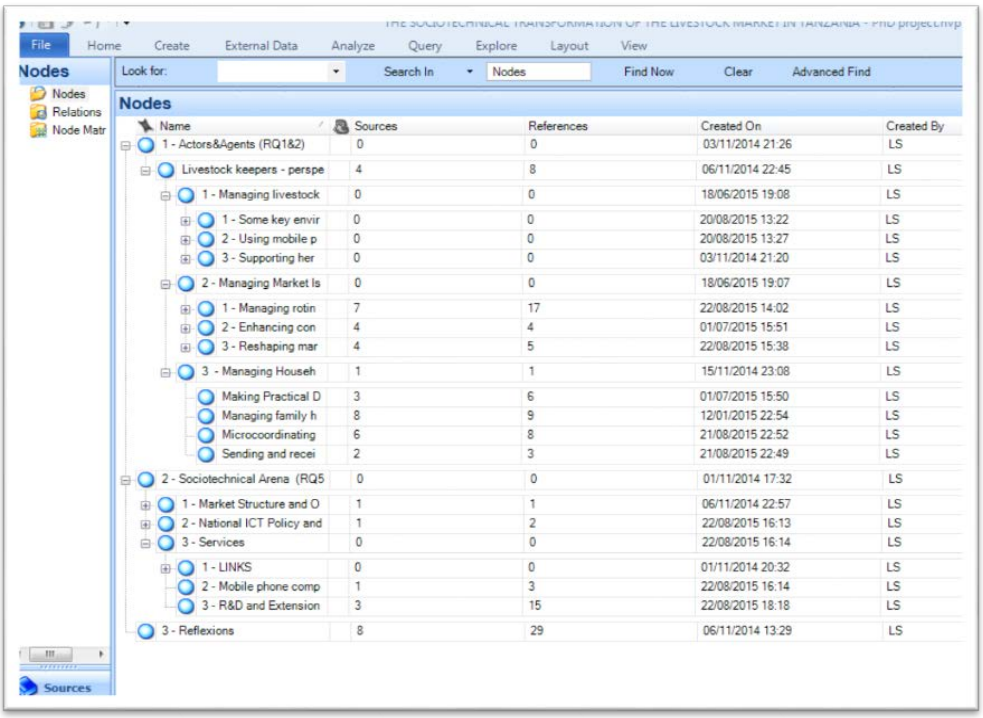


Figure 5 - Breaking down the main categories in subcategories or analytical codes (Ritchie, Lewis, Nicholls, & Ormston, 2013, p. 272)

when the pastoralists use the mobile phone and for what purpose. This allowed me to undertake a more in-depth analysis of the data and address the research questions, emphasizing that the aim was to "produce a meaningful account of the phenomenon, and to produce this account in a systematic and transparent way so that the reader can see how concepts, themes or categories were developed" (Ritchie et al., 2013, p. 278). This gave me the chance to build a structure of evidence, supported in a rigorous and systematic management of raw material, ensuring the same analytical treatment of all data, and moving from a superficial level of explanation towards a more generic and abstract interpretation of the data, safeguarding that explanations would be grounded in the data and not superimposed.

2.3.2.6. Some ethical considerations

By doing a self-audit ethical review[8], following all the parameters and procedures imposed by the Research Ethics Committee of the School of Political and Social Studies, I ensured that the research and researcher was cleared from potential risk, and as well as pre-empting chances to open up confidentiality breaches whilst unfailingly ensuring that verbal informed consent would be obtained from all participants. In this case, it is important to state that the decision to obtain verbal informed consent was done bearing in mind the characteristics of the fieldwork and the nature of the activity and actors being studied. It would not be practical to request participants to read and sign documents during times of activity in the market, because this would eventually make some interviews unfeasible.

In seeking verbal informant consent I ensured that I would fulfil the standard procedure, making clear to all participants that the research findings would not be used in a way that would adversely affect them or any particular group of people. I also made certain that the data collection process would not induce any psychological stress or discomfort, and that it would not be physically invasive, nor would it involve sensitive topics which would lead informants to disclose confidential or personal information. The ethical principles that nourish this research, as stated in the research ethics form[9] have been preserved integrally mainly when safeguarding the correct use

[8] Please see Appendix 6
[9] Idem

and handling of the information acquired under informed consent obtained from all participants whom I verbally requested, and obtained with full consent for the purpose of recording the interviews, and getting permission to use names and the information collected under the research objectives.

In discussing informant consent with those actors, I explained the research objectives, enabling them to reflect on the benefits and potential costs of participating, and therefore make the decision to take part in the study or not. This was critical, mainly if I consider that some of the interviews were sought using the snowball sampling method which required me to act fast in order to not lose the opportunity to conduct the interview, but also to ensure that I would not open up any breaches of the ethical principles inherent to this research. I did not doubt that the best approach would be to always obtain verbal informed consent. Nevertheless, in some circumstances, this brought important ethical dilemmas, not dramatic issues, but enough to alert my ethical conscience and reflect upon whether I should or not use the material to which I gained access in the eventual absence of that consent. I had some informal conversations with some relevant participants, which were not planned and therefore I lost the chance to secure prior informed consent, and consequently those conversations were not recorded. However, and because I noted these facts in the field diary as a direct result of my observation and reflections, I felt it desirable to use this information as it would increase clarity and help to enhance the reliability and validity of my findings. Nevertheless, I took special precautions to preserve the confidentiality required by the participant as would be done if verbal informed consent had been given initially. As such, in some of the empirical chapters there will be some residual data input done under field notes.

Another aspect to flag is language, an issue that also brought implications. As noted in 2.3.2.1., the accuracy of interpretation emerged as a relevant aspect to bear in mind, whilst trying to eliminate bias as much as possible. To tackle this issue and considering that my local language (Swahili) proficiency was not great, I opted to have, whenever possible, a second interpreter, complementing the role played by the livestock market officer (who frequently undertook the role of research assistant) or vice versa. This strategy revealed important information in some interviews, where I had the opportunity to compare responses in order to allow the emergence of the real meaning

of the respondent's perspective and ensuring that nothing would be lost in translation, and somehow mitigating my handicap, i.e. not able to master Swahili in order to pick up important details.

Another aspect of key relevance was the limitations of funding to conduct the fieldwork in a country the size of Tanzania and with the need to undertake long journeys, which very often took several days of travel across different regions from my headquarters in Dar es Salaam (DSM). Consequently, during the fieldwork stage, decisions needed to be always dynamic and flexible in response to the circumstances imposed by those financial limitations. For instance, I had to programme the maximum number of encounters per region, day and spot visited in order to maximize the relation between investment and data collected. This made the field work intense and increased the need to conduct regular risk assessments concerning locations and exposure. Again, the decision to follow the panel's recommendation to focus on one country was important. Tanzania is a relatively stable country, where there is an absence of military conflicts or wars, and the relatively stable socioeconomic environment allowed me to undertake journeys through the unknown in relative safety. Nevertheless, and because some roads and transportation did not offer reasonable levels of security, in some circumstances I often opted to return to my HQ, and approach a given region from DSM, because I did not find it safe to try and commute from one region to another directly. This gave me the opportunity to cover a large portion of the country, and to grasp the socioeconomic level of development of Tanzania. One last aspect concerns the storage and preservation of the data. During the fieldwork, the data were stored in an encrypted folder in an external hard disk. During the transcription and data analysis process, and after I had set up the NVivo software in the laptop computer, I downloaded all the relevant interviews into the software, and after that uploaded both the remaining interviews and the NVivo main folder to my Dropbox account. Backup copies were made regularly and saved into the encrypted folder in the external hard disk.

2.3.2.7. Notes on terminology

One last note for the reader who, when reading this thesis, should consider that the word market will emerge frequently in italics (*market)*. This is to make a clear

distinction between the place where cattle are effectively traded, and markets in a more generic and abstract sense, i.e. the market as a system. In addition, the term appropriation will often appear in italics. In that circumstance, I am referring to the concept, and in all other circumstances it will be presented as a noun. Another aspect of key importance is that when presenting the data, mainly in chapter 7 and 8, I attempt to show a proportional view of the two regions (Arusha and the Lake Zone), which have significant socio-economic differences. Therefore, the data collected cannot be completely identical for each of the sub-topic area, although the data collection process was carefully conducted in order to allow a systematic data analysis process.

2.4. Reflection

Embarking on an ethnographic journey brings along some important challenges. For instance, Geertz suggests that, "the ethnographic method [is] an interpretive project [, however such] an approach challenged the pretensions of "scientific objectivity" that legitimized the ethnographic method as social science" (Geertz [1973], 2008, p. 29). Engaging with this sort of epistemological issues poses a few important questions, which forces me to reflect on what I expect as the outcome of my research journey and what I should have done better to try to tackle the "common criticism directed at so-called qualitative investigation […] namely that it fails to adhere to canons of reliability and validity" (LeCompte & Goetz, 1982, p. 31).

As I said previously, I have strived to be very meticulous and coherent during the process of data collection and analyses, namely when seeking to understand the phenomenon from different perspectives and accounts, which is part of the triangulation process of ethnographic research. The allocating of the data according to an explanatory logic helped the research to obtain a systematic view of the ontological world, through structuring the "unstructured"(Hammersley & Atkinson, 2007, p. 3). This gave opportunity to create a stratified hierarchy of meaningful structures, which paves the ground for the reliability and validity this research aims to achieve.

2.5. Concluding remarks

As noted initially, this study was set out as a regional comparative analysis, therefore it has made use of a cross-sectional analysis to compare and contrast Arusha and the Lake Zone with regard to livestock production and marketing. The use of NVivo allowed organisation of the data according to an explanatory logic in order to obtain a systematic view of the terrain and issues to be discussed in more detail. This strategy permitted me to coherently and consistently organize information and to map the arena in what concerns the livestock market structure and dynamics, which later would allow for the creation of themes for each of the empirical chapters. After splitting the data collected into those six regions and creating those main categories it was possible to build a set of subcategories, which helped to characterise and compare both regions and how the use of mobile phones is contributing, or not, to the improvement of livelihood activities and coping with hardship (chapter 7); how the mobile phone is used when a decisions has to be made whether to sell or buy cattle, and where and at what price; and, to manage issues of security and hazard (chapters 8&9), as we will see in the following chapters of this thesis.

Chapter 3 - Context of study: socioeconomic profile of the Lake Zone and Arusha

I will now introduce the context of this study, beginning with the socioeconomic profiles of Arusha Region and Lake Zone (sections 3.1. and 3.2.). I will justify my choice of fieldwork location, pointing out the level of development in each location, as well as mobile connectivity (3.3.), and underlining their importance for livestock production. I selected Arusha region as the location to study Maasai livestock dynamics. With regards to Wasukuma livestock dynamics, I selected Mwanza and Shinyanga Regions which are representative of the Lake Zone in livestock dynamics. Therefore, when speaking about the Lake Zone, I am doing it based on information collected and observation made in those two regions. In section 3.4. I will summarise the chapter with brief concluding remarks.

3.1. Arusha regional profile

Located in the north-eastern corner of Tanzania and bordering with Kenya (in the North) and with Kilimanjaro (in the East side) and in the South with Dodoma, Arusha is one of the most vibrant and productive regions in the Tanzanian mainland.

Figure 6: Arusha Region

The region is 82,428.5 sq.km in size, of which 3,571 sq.km. are covered by water due to the existence of important bodies of water such as the Lakes Eyasi, Manyara, Babati and Natron, nevertheless during the dry season this percentage is reduced substantially. The territory is divided into six districts: Arusha, Arumeru, Monduli, Karatu, Longido and Ngorongoro, and the population totals 1,694,310 inhabitants[10], of which 360 thousand are Maasai, although they are not permanently in the region due to the semi-nomadic character of their activity and the need to search for new sources of livelihood, which leads them to regions as far away as Tanga and Lindi.

Serial No.	District/Council	Population (Number)			Average Household Size	Sex Ratio
		Total	Male	Female		
	Total	**1,694,310**	**821,282**	**873,028**	**4.5**	**94**
1	Monduli District Council	158,929	75,615	83,314	4.7	91
2	Meru District Council	268,144	131,264	136,880	4.3	96
3	Arusha City Council	416,442	199,524	216,918	4.0	92
4	Karatu District Council	230,166	117,769	112,397	5.1	105
5	Ngorongoro District Council	174,278	82,610	91,668	4.8	90
6	Arusha District Council	323,198	154,301	168,897	4.5	91
7	Longido District Council	123,153	60,199	62,954	5.0	96

Table 2- Population of Arusha Region by Sex, Average Household Size and Sex ratio. Source National Bureau of Statistics, Ministry of Finance, The United Republic of Tanzania[11]

The overall gross domestic product per capita is $1.3. Billion US and the region is the seventh richest in the country after regions such as Dar es Salaam, Mwanza and Shinyanga[12]. Side by side with tourism, agriculture sits importantly in the economy of the region. The region has an area of 102,573 ha of arable land for cultivation, and the main cash crops are coffee, onions, wheat, barley, pigeon peas, and sisal. The food

[10] Source: Arusha Regional Commissioner's Office: http://www.arusha.go.tz/economic-activity/kilimo, accessed on 01.04.2017

[11] https://web.archive.org/web/20130612082906/http://www.nbs.go.tz/sensa/PDF/Census%20General%20Report%20-%2029%20March%202013_Combined_Final%20for%20Printing.pdf, accessed on 06.05.2017

[12] http://www.thecitizen.co.tz/News/national/Dar-tops-wealth-list--Arusha-7th-despite-tourist-charm/1840392-2016862-8u3yfuz/index.html, accessed on 06/05/2017

crops comprise maize, beans, finger millet, sorghum, and wheat, which are predominantly produced in Arumeru, Babati, Ngorongoro, Karatu and Monduli. The latter three districts are livestock production heavy and inhabited predominantly by Maasai pastoralists.

Notwithstanding the potential for agriculture, a considerable part of the region is classified as national park, with the Arusha National Park occupying 137km^2 of land and the Serengeti National Park extending over 14, 763km$^{2.}$ This has determined land management since the British colonial government set out a policy for appropriation of land to enlarge the national parks that were established during the 1920s, augmented by the National Parks Ordinance of 1959, making it illegal for anyone to reside, except for purposes of management, tourism or research, within the area traditionally known as Maasailand, which extends up to the south of Kenya.

Along with Dar es Salaam (the financial capital) and Dodoma (the political-administrative capital), Arusha region plays an important role in the socio-political and administrative structure of modern Tanzania. Relevant historical events took place in Arusha, for instance the official documents granting independence to Tanganyika were signed by the United Kingdom at Arusha in 1961, and the Arusha Declaration was signed there in 1967. More recently, in 1994, the UN Security Council decided that Arusha would host the International Criminal Tribunal for Rwanda which is now closed and was replaced by the International Residual Mechanism for Criminal Tribunals. Arusha also hosts the headquarters of the East African Community and the Arusha International Conference Centre, which attracts middle class east Africans to set up residence in the region, mainly in Arusha city.

Regarding the economy of Arusha, the region depends significantly on crops, livestock and tourism, which constitute a basic source of livelihood for many thousands[13]. Arusha is a global tourist destination, and the gateway to Serengeti National parks and reserves include the Ngorongoro Conservation Area, Arusha National Park, the Loliondo Game Controlled Area, Oldonyo Lengai, Olduvai Gorge and part of Lake Manyara National Park.

[13] No regional sectorial data exist

Regarding transportation infrastructure, the region is endowed with key roads connecting Arusha to Moshi, Arusha to Nairobi, and Arusha to DSM. Kilimanjaro International Airport serves the cities of Moshi and Arusha, and Arusha Airport (Kisongo) serves small planes used mostly to visit tourist areas, and for NGOs initiatives such as the Flying Doctors to gain access to remote areas to provide medical assistance.

- **Livestock sector**

Livestock activity is important in Arusha region because it is the main source of livelihood for rather a large group of the Maasai that inhabit the region. Together with the Lake Zone, particularly Mwanza and Shinyanga regions, they are the major producers of cattle in the country. However, there are distinct differences in the forms of livestock production. In the majority of the districts of Arusha region pastoralism, or pure pastoralism, is prime, with the cattle keepers (mainly Maasai people) driving the cattle from one area to another (sometimes crossing the border) to seek for better pastures and water. According to recent data[14], it is estimated that Arusha has a total of 5,704,334 livestock units, as per table 3 below.

Region	Cattle	Goats	Sheep	Chicken	Pigs
Arusha	1,373,839	1,497,361	1,138,852	1,673,702	20,580

Table 3: Number of livestock in Arusha region according to National livestock population census 2014. Source Regional Commissioner's Office

There have been some attempts to shift the modus of production, and some initiatives promoted mainly by aid agencies aiming to tackle issues of land conflicts by incentivizing individuals to embrace fattening processes (feedlot schemes) and cross breeding using the Boran/Sahiwal breeds to increase the genetic potential of local animals (Tanzania Short Horn Zebu) and increase the capacity and speed of gaining weight.

The government has sponsored the implementation of projects to develop the hides and skin sector in the region. The initiative started in the year 2007/2008 and involved five out of seven districts and respective Local Government Authorities (LGA),

[14] http://www.arusha.go.tz/index.php/economic-activity/ufugaji, accessed on 08/05/2017

namely Arusha City, Karatu, Meru, Monduli and Ngorongoro. Some activities undertaken include construction of hide and skin drying sheds, training on hides and skin processing, and rehabilitation of slaughter slabs. At present, there are three leather processing industries (Salex Co. Ltd, Ngozi Centre and Asilia Ltd). They are part of the value addition chain, manufacturing leather products. There are ten small scale groups for leather processing in Arusha, Arumeru, Longido and Ngorongoro districts. These small factories and groups have the capacity to process up to 45,600 pieces of hides, and 49,200 pieces of skin per year.[15]

In the transformative sector, at the time of the fieldwork, I was pinpointed the existence of one modern abattoir in Arusha City, and plans to build another in Monduli by a Non-Governmental Organisation called African Wildlife Foundation (AWF). This abattoir is planned to have the capacity to slaughter 50 cattle per day.

Arusha has four secondary markets[16] but only two are working, located in Mesarani and Themi. The other two, Longido and Waso, in Ngorongoro division, are officially not working. However, I had the chance to visit Waso market and to witness a vivid and dynamic market where prime livestock are sold to Kenyan middlemen.

Figures 7 and 8 - Trading activity in Waso market, Loliondo, Arusha region. (picture taken by the author).

[15] Idem

[16] Description of the primary and secondary markets will be found in the appendix 5, e.g. Kizota

There are another 28 primary markets and 59 places that are locally arranged for livestock marketing. In the dairy sector, the region has six milk processing industries. The International Dairy Co. Ltd, with a processing capacity of 3,000 litres of milk per day, and Arusha Dairy Co. Ltd, with capacity of 1,500 litres, stand out as the two key processing units in this region.

As a preventive measure, because of cholera, the regional authorities banned a total of 26 open air livestock markets at the beginning of 2016. From the seven district councils, only two were issued with permission to operate - Karatu and Ngorongoro[17]. To summarise, Arusha region has strong livestock production which is an important element in the socio-economic dynamics of the country, having the potential to build its livestock value chain, with the addition of projects to enhance the processing and transformation of livestock products and derivatives.

- **Who are the Maasai?**

The Maasai are seen as a Tanzanian cultural symbol. They represent a substantial part of the groups of Maa speakers of East Africa. Their culture has had strong continuities since the mid-18th century (Galaty, 1982; Potkanski, 1994), and they can be found living in areas of northern Tanzania and southern Kenya. The iconic image of the Maasai society is of an age group of men from 15-45 years old, including junior warriors, senior warriors, and junior elders (sometimes classed as senior warriors), referred as the Warriorhood[18]. They are known mostly as tall and fierce warriors, even if their main activity is not related to war, but rather cattle keeping. They can be recognised by the special red cloth which they wear, called *Shuka*. The way they dress changes according to gender, age status and specific circumstances. For instance, the colour black is used amongst boys for several months after circumcision, a time when they have to live in segregation (Hendry, 2013, p. 149; Talk, 1987, p. 58), and red shuka is used after that, when they become junior warriors, i. e. *Moranis*. The Maasai are predominantly pastoralists. They live a semi-nomadic life, moving from one place to another with their cattle. It is normal for those responsible to trek their cattle herds to move for many miles often for days, in order to find pastures and water. Normally

[17] http://allafrica.com/stories/201601251898.html, accessed on 08/05/2017
[18] (Spencer, 1965)

they settle in *bomas*[19] (please see fig.9, below) for a given period of time so that the herd has the opportunity to graze. Their diet is composed mainly of meat, milk, seeds, grains, sugar, and oil, some of which items are obtained by trading (or exchanging) with other tribes, Maasai and otherwise. Blood is an iconic part of the Maasai diet, but nowadays it is used only in special circumstances, mainly to celebrate. Regarding garments, in addition to the *Shuka*, the Maasai wear another well-known artefact, that emphasizes their particularity; they permanently carry a spear if a warrior, or a stick if a herder, and both artefacts are used in cattle keeping, sometimes to protect their cattle from wild animals or just to control the herd during the trekking and grazing periods. Those, more than the artefacts or tools to be used in a daily basis, represent a symbol, the material culture expressing their identity.

Figure 9: Boma in Loliondo, Arusha Region, Tanzania (picture taken by the author)

[19] A Boma, is the temporary place where the Maasai pastoralists overnight with the cattle during the long period of grazing. The term was generalised to indicate the equivalent to homestead, which is more common in the Lake Zone. Technically the term is used to describe a livestock enclosure. It is also known in other regions of Africa and of the Southern Caribbean Sea as *Kraal* which is derived from the Portuguese word *curral*.

- **The role of women in Maasai social structure**

Women are now more integrated into the social structure and participating actively in key moments of Maasai social life and affairs, such as defence of the land. For instance, I was told[20] that in recent tensions regarding attempted land evictions, known as the Loliondo Gate, Maasai women had a key role defending what they claim as ancestral land. I also observed some important changes, which confirms the literature (Talk, 1987, p. 52), with some shifts in the power relations within the social structure. In general terms, Maasai women play the traditional role within a male dominant social structure, being responsible for the household activities such as cooking, collecting wood to be used as firewood and/or to build their home. Nevertheless, I witnessed that it is now possible to find some Maasai women trading in livestock markets, something that traditionally was not possible. This is a significant transformation in the Maasai social structure (Dutt, Grabe, & Castro, 2016, p. 380) and in the power relations in a patriarchal society.

- **How do the Maasai live?**

Many Maasai have remained faithful in many respects to their culture, using few of the objects of our material world, though they do use the mobile phone. Many Maasais still live a simple life, supported mainly by cattle keeping, and trading livestock. They are pre-eminently pastoralists. "Being a Maasai" is centred on cattle keeping: this is what makes a Maasai to be a Maasai, one central and preponderant topic in anthropological and East African studies (Hodgson, 2011; Spear & Waller, 1993). For the Maasai cattle are what makes their life good, since they consider meat and milk as the best foods a Maasai can consume to nourish their body and soul. One Maasai ideal is to live from their cattle alone. However, some socio-economic and natural environmental factors, and important changes of weather patterns, are determining some critical alterations to their lifestyle and livelihood, and some Maasai are becoming more settled and are growing crops (Hodgson, 2011, p. 188). Another particularity of the Maasai is their resilient character, which is important for facing the challenges of the Ngorongoro region, where their homeland (Loliondo) is situated.

[20] Information collected in an interview with members of the NGO Women Pastoralist Council based in Arusha and operating in Longido

Ngorongoro is one of the harshest districts in Arusha region, and one will travel for miles and hours before seeing any signs of human presence and/or hints of development. The landscape is sand, earth and dust, and one of the reasons can be attributed to the pattern of rainfall, which has been decreasing over the years. This is still one of the most impressive images (please see fig.10 below) from research done in Loliondo[21]. The figure, which emerges blurred and making it almost impossible to see the pastoralist, shows us the harsh conditions that the Maasai pastoralists are exposed to during the long periods of trekking. They move their herds from one place to another with seasonal movements searching for the best grazing areas. In the past, this was a strategy so that the grass would have the chance to grow again, with freedom to move across common land, to access and to share those key

Figure 10: Maasai pastoralist facing the harsh conditions of the region near Lake Natron (picture taken by the author).

[21] "*It is striking to see these people trekking cattle in the middle of nowhere, some of them children, and apparently without any resource; this is something that I need to bear mind when writing about the changes brought about by the mobile phone. The driver told my interpreter that normally they always carry a mobile phone and more than one battery so they have always the chance to contact someone and therefore they are not alone."* In field notes, Monduli 13th August 2014

resources. This was possible due to a land tenure system in which everyone belonging to the same clan, or tribe, would have access to land and sharing water and pasture.

At present, it is very hard to operate such practices, due to critical changes in land access and tenure, and the policy of wildlife corridors introduced by the Tanzanian government. The Maasai people have increasingly been forced to settle, or to migrate and find other jobs in "Arusha city or in Dar es Salaam (DSM) as night watchmen, security guards, casual labourers, and other positions in the informal economy" (Hodgson, 2011, p. 195).

- **Social structure and religion**

Social structure is not the main focus of this research, but it is important to briefly describe those elements that inform and shape production strategies. There is a large body of literature about the Maasai social structure, but I chose to describe those elements that I observed during fieldwork data collection. The structure of the Maasai was briefly explained to me by a Maasai man working as a tourist guide in Monduli region. According to this informant, the structure of Maasai society is centred on male age-groups, and each set group is separated by about 15 years. Those members pass together through different age stages, from *Moran* (just after the initiation) until they become *Warriors* (total independence is obtained after 7 years), then after their active years as *Warriors* they become *Orpayan* (adult age after being a warrior) and then *Elders* (senior age). There are no chiefs. The highest position in the social structure is the *Laiboni*, or the spiritual leader, who is the head of the social stratification. One level below is the *Olaigwanani*, a sort of community leader, normally selected among the *Orpayan*. The Laiboni will always descend from a family of *Laibonis*, and the power, and as well as the knowledge and the artefacts, are inherited from fathers and grandfathers. Concerning religion, Maasai believe in one god, the *Engai*. To explain this entity, I use an oral story that was told to me by the same tourist guide and retold by one *Olaigwanani* during two informal conversations I had during the pilot study conducted in 2013. The story, as told to me by the two informants, says that *Engai* is the creator of everything:

> *"Engai, which means sky, formed together with the earth one single unit. Engai was the most powerful identity and owned all the cattle of this world. One day the earth and sky*

> *separated, and Engai become a sort of spirit and no longer living among men. However, someone was needed to take care of the cattle that needed the grass only available in the earth. As such Engai trusted the cattle to the Maasai and told them to look after them, the reasons why all Maasai still believe that they are the owners of all the cattle of the world."* (In field notes, Monduli, November 2013).

This sort of legend is still very grounded at the centre of what is claimed "being Maasai" (Hodgson, 2011; Spear & Waller, 1993), since cattle still play an important role in the main rituals such as initiation, marriage, and the passage of one age-set to the next, where the sacrifice of cattle bridges the gap between a Maasai person and *Engai*, and the earth and sky. Those believing in *Engai*, the majority, normally follow Laiboni leadership. Other Maasai converted to Roman Catholicism to give young Maasai access to education in the missionary schools, which has left the religion imprinted on the "Maasai life via names, songs, laws/policies and expectations" (Martinez & Waldron (2006, p. 409).

- **The problems they face**

At present the Maasai are exposed to a multitude of factors that are endangering their main source of livelihood and existence. Difficulties in accessing good pastures, resulting mainly but not only from laws and policies constraining the freedom to move, is a critical constraint and it is outwith Maasai control. Land availability and freedom to move emerge as the main elements restraining Maasai pastoralists' activity, increasing the competition for land and natural resources (Hodgson, 2011, p. 183). Those sets of factors interplay and make it very difficult for them to graze or to sell near home, at least for good prices, and this was one of the most visible and recurrent aspects I saw during fieldwork. There is a sense that both groups of producers need to travel further with the herds, however the mobile phones seem to alleviate that burden. I will develop this discussion in the empirical section.

3.2. Lake Zone (Mwanza & Shinyanga) profile

The second livestock production area selected for this comparative analysis is the Lake Zone, with special emphasis on Mwanza and Shinyanga regions, two of the most economically important regions in Tanzania. Mwanza and Shinyanga are amongst the richest regions in Tanzania. Mwanza is in second position, and Shinyanga is the

fourth[22]. Mwanza region accounts for 30.9 per cent of the country's GDP, followed by Shinyanga Region with 20.3 per cent.

Mwanza region has a population of 2.7 million and contains Tanzania's second biggest city, i.e. the city of Mwanza. Shinyanga has a population of 1.5. Million, and the regions together constitute the business hub of the northern zone of the country, located on the shores of one of the most significant natural resources in the country, Lake Victoria. Tables 4 and 5 in the next page contain further information.

Figure 11 – Mwanza and Shinyanga regions

[22] http://www.thecitizen.co.tz/News/national/Dar-tops-wealth-list--Arusha-7th-despite-tourist-charm/1840392-2016862-8u3yfuz/index.html, accessed on 06/05/17

Serial No.	District/Council	Population (Number)			Average Household Size	Sex Ratio
		Total	Male	Female		
	Total	**2,772,509**	**1,360,381**	**1,412,128**	**5.7**	**96**
1	Ukerewe District Council	345,147	169,279	175,868	5.8	96
2	Magu District Council	299,759	146,461	153,298	5.8	96
3	Nyamagana Municipal Council	363,452	177,812	185,640	4.7	96
4	Kwimba District Council	406,509	198,096	208,413	6.5	95
5	Sengerema District Council	663,034	330,018	333,016	6.0	99
6	Ilemela Municipal Council	343,001	164,718	178,283	4.8	92
7	Misungwi District Council	351,607	173,997	177,610	6.5	98

Table 4 – Population of Mwanza Region by Sex, average Household Size and sex Ratio. Source: National Bureau of Statistics, Ministry of Finance, The United Republic of Tanzania[23]

Serial No.	District/Council	Population (Number)			Average Household Size	Sex Ratio
		Total	Male	Female		
	Total	**1,534,808**	**750,841**	**783,967**	**5.9**	**96**
1	Shinyanga Municipal Council	161,391	78,655	82,736	4.8	95
2	Kishapu District Council	272,990	135,269	137,721	6.3	98
3	Shinyanga District Council	334,417	162,956	171,461	6.3	95
4	Kahama District Council	523,802	256,463	267,339	6.3	96
5	Kahama Town Council	242,208	117,498	124,710	4.9	94

Table 5 - Population of Shinyanga Region by Sex, average Household Size and sex Ratio. Source: National Bureau of Statistics, Ministry of Finance, The United Republic of Tanzania

[23] https://web.archive.org/web/20130612082906/http://www.nbs.go.tz/sensa/PDF/Census%20General%20Report%20-%2029%20March%202013_Combined_Final%20for%20Printing.pdf, accessed on 06.05.2017

The lake lies between Tanzania, Uganda and Kenya and is the largest lake in Africa, and contains more than 200 species of fish, of which the Tilapia is the most popular and very important in economic terms. The fishing industry is one of the strongest sectors of economic activity, side by side with mining (gemstones and gold) and agriculture (cotton, maize, rice and livestock). The Lake Zone is constituted in total by 7 regions: Geita, Kagera, Kigoma, Mara, Mwanza, Shinyanga and Simiyu, all with important livestock activity. The zone comprises 45 districts, with Mwanza and Shinyanga the most important for livestock production. Mwanza was known in the past as Sukuma land, and it connects with Arusha through the immense Serengeti Plain[24], where one of the most important national parks is located. However, unlike Arusha region, the Lake Zone was not torn apart by national parks. It is an integrated economic zone, with the fisheries and maritime as two outstanding industrial sectors. The city and region of Mwanza benefit from the economic output of the other regions surrounding the lake.

The Lake Zone has a better developed and integrated infrastructure than the majority of the other regions, including Arusha (with exception of Arusha city). It has one airport and key access (roads and sea) connecting to other neighbouring countries: Burundi, Rwanda, Uganda, and Kenya. The zone is extremely important in Tanzania for maize, rice and cotton production, and the two first compete aggressively with the third for land, labour, and farmers' cash.[25]. Fishing (Mwanza) and mining (Shinyanga) represent alternatives to both livestock keeping and crops. Tanzania is one of the largest fishing nations in Africa. According to FAO it is ranked in the top ten countries in terms of total fisheries capture, and the contribution of Mwanza is significant. Mining is significant for both Mwanza and Shinyanga. The existing natural resources are very significant and strategic for the country, mainly in what concerns mineral production. There is a large artisanal mining tradition is these regions, which constitutes an alternative source of livelihood for several hundred thousand people, "ranging from semi-mechanized family operations to East Africa's largest industrial gold producer, Geita Mine" (Bryceson, Fisher, Jønsson, & Mwaipopo, 2013, p. 13).

[24] Here is the original land of the Maasai

[25] Adoption of Maize Production Technologies in the Lake Zone of Tanzania, http://repository.cimmyt.org:8080/xmlui/bitstream/handle/10883/990/68097.pdf, accessed on 06.05.2017

- **Livestock sector**

Along with crops and fisheries, livestock emerges as a relevant sector of activity in the Lake Zone, contributing significantly to the GDP of the region. According to the Livestock Population Distribution in Tanzania - 2009/2010 (MLFD, 2010), the two regions contain a total of approximately 5 million cattle out of the approximately 22 million Livestock Units (LSU) existing in the entire country. This is the reason I chose these regions in order to undertake the comparison with Arusha region. A substantial number of the cattle that arrive at Pugu in DSM (the country's largest livestock market) come from the Lake Zone. The SAAFI abattoir in DSM plays a major role is this flux, using cattle from the Lake Zone, fattened in Dodoma region, and killed for export to Zambia, Democratic Republic of Congo, Malawi and more recently Angola. Mwanza has the highest livestock density in the country, and the third largest total herd (see table 6 below).

District	Cattle	Goats	Sheep	Donkeys	Pigs
Sengerema	305,936	169,042	9,801	281	526
Misungwi	244,894	84,106	12,576	879	281
Kwimba	390,991	135,035	79,383	5,500	300
Magu	230,994	59,654	36,551	50	481
Ilemeda	45,931	17,467	3,782	-	52,128
Nyamagana	30,012	624	2,129	-	57,013
Ukerewe	53,562	31,285	205	-	590
Total Region	1,302,320	497,213	144,427	6,719	111,319

Table 6: Number of livestock in Mwanza districts for the year 2011. Source, Regional Commissioner's Office 2012

The increased meat production for intra and inter-regional consumption and hides and skins for domestic consumption and export are produced here. The region is endowed with very good quality pasture land (287,319Ha), which helps to explain the quality of the livestock population.[26] In Shinyanga, livestock keeping is also important: it is the second (after crops) most important economic activity for the majority of the residents. Cattle are the dominant livestock production, which accounts for 36.4 percent of the regional total livestock population (see Table 7 below).[27]

District	Cattle	Goats	Sheep	Donkeys	Pigs
Kahama	359,159	186,371	81,833	13,345	610
Kishapu	354,235	179,116	83,612	1,606	326
Shinyanga rural	422,809	166,520	118,614	3,452	218
Shinyanga urban	61,469	54,118	16,964	701	2,316
Total Region	1,197,672	586,125	301,023	19,104	3,470

Table 7: Number of Livestock in each district of Shinyanga for the year 2012. Source: data compiled from the Council Directors' Offices, Shinyanga Region, 2012

Who are the Wasukuma?

According to Wijsen (2002) any study of the Wasukuma today would need some description of their life prior to the beginning of colonialism in order to detect their origin and growth as an ethnic group, mainly because only after political independence did the Sukuma become an object of academic research. There are only a hundred studies on the Wasukuma people, with just few written by Wasukuma authors, which forms a "meagre representation of the lives of a people" claimed to be the largest ethnic

[26] http://www.lakezoneinvestmentforum.go.tz/lake-zone-region, accessed on 19/03/15
[27] Idem

group of Tanzania[28]. Mirambo (2004) suggests that the oral story of the Basukuma, the tribe who lived on the Western side of Lake Victoria, is a relevant starting point for any research to understand the origin of the Wasukuma ethnic group. Therefore, my description does not attempt to fill that gap but rather uses relevant data from the literature, grounding the description mainly in my ethnographic journey in the Sukuma land and on oral stories told me there. For instance, it is said that the Wasukuma tribe result from an extensive migration of people speaking early forms of Bantu, who originally came from western Uganda.

Also, there is a Sukuma oral story that indicates that this group of Bantu speakers moved from Uganda to establish their kingdoms further west, around Lake Victoria. Another oral story points to the widely-accepted narrative of Nkanda,[29] early leader of this tribe, pointing out that a group of people, coming from Lushamba, nowadays Geita District, settled at one site about 12 miles from what is known today as Mwanza to rest and then they settled there. The story says that the group was exhausted from the long journey, and therefore decided to camp under the leader Nkanda's (pinpointed as the first chief of the Wasukuma tribe) suggestion, which was expressed in their original language: *Nye-Nsukumale aha* (let me camp here), and from that time till now this settlement become famous and is called *Sukumale aha*. Later, when Sanga was officially enthroned as chief of this people in 1504, the name become more formal and the place was definitely referred as Sukuma land (Mirambo, 2004).

- **How do the Wasukuma live?**

The Wasukuma divide their agricultural activity into two major sectors: crops and livestock. According to their ancestral tribes, they belong to the Bantu-speaking subgroups Kisomao, prone to grow crops, and the Kinakia which relied more on herding cattle. However, they both farm and herd cattle simultaneously, which make them agro-pastoralists, allowing us to draw an interesting contrast with the Maasai people, who are eminently pastoralist.

[28] https://www.africa.upenn.edu/NEH/tethnic.htm
[29] http://sukupeechtpc.blogspot.co.uk/p/sukuma-basukuma-wasukuma-zukuma.html, accessed on 09/01/16

- **What problems do they face?**

As with Arusha region, the pressure on grazing land is also an issue and "is quite intense, and the magnitude of land degradation seems to have overwhelmed the indigenous people who previously used to live harmoniously with available natural resources" (Selemani et al., 2012, p. 5537). There are some specific issues affecting the region such as the degradation of vegetation, resulting from colonial period actions aiming to eradicate *tsetse flies* and *typanosomia* and the programme of *villagization* implemented during the 1970s by the post-colonial Tanzanian government. Both have contributed to reduce the use of the traditional strategy to manage land and herds, known as *Ngitili*, which is a communal form of land management. This particular strategy involves retaining an area of standing vegetation from the beginning of the rainy season and opening it up for grazing at the peak of the dry season. The fast pace of urban development, which brings speculation over land and properties, and also the massive industrialization to which this region has been exposed with the expansion of gold mining, has brought important changes in agrarian strategy. At present *Ngitili* is used in a more private perspective, which is referred to as individual private *Ngitili* (Selemani et al., 2012, p. 5538). Three factors affect livestock production: **i)** the overwhelming land scarcity due to the governmental gradual appropriation of land; **ii)** this has led to overgrazing of the remaining land, and **iii)** irregularities of rainfall which accentuate the two previous issues.

3.3. Mobile Communications

ICT infrastructure in Tanzania has changed over recent years, with substantial alterations that have improved connectivity. For instance, major transformation took place with the construction in 2009 of SEACOM that has connected Tanzania, and East Africa, to Europe. This is part of a macro strategy that aims to place Tanzania in a strategic position in East Africa. The Internet is today more accessible and affordable to a considerable proportion of the Tanzanian population, even though there are still many challenges to be overcome, in order to put Tanzania, and sub-Saharan African countries '*on-the-grid*'. Internet and mobile communication still have limited coverage in the most isolated locations often used by pastoral communities, notwithstanding

evidence suggesting that it has great potential for livestock trade. Mobile phones and SMS emerge as probably the most popular form of mobile communication throughout Tanzania. The mobile phone has emerged as a real option for all: policy makers, innovators, implementers and users. Tanzania is the second largest mobile communications market in East Africa (percentage of SMS shares in fig.12 below). Data suggest that Kenya, Tanzania, Uganda and Rwanda have currently 37.6 million mobile subscribers, with a penetration rate of around 30 per cent. This represents a compound annual growth rate of almost 15 per cent.

4.1 Local and International SMS

Destination	JANUARY	FEBRUARY	MARCH	TOTAL
Local On Net SMS	2,518,440,913	2,210,286,636	2,364,323,956	**7,093,051,505**
Local Off Net SMS	1,492,264,169	1,284,985,297	1,315,828,191	**4,093,077,657**
International SMS	1,681,132	1,473,587.0	1,214,894.0	**4,369,613**
TOTAL	**4,012,386,214**	**3,496,745,520**	**3,681,367,041**	**11,190,498,775**

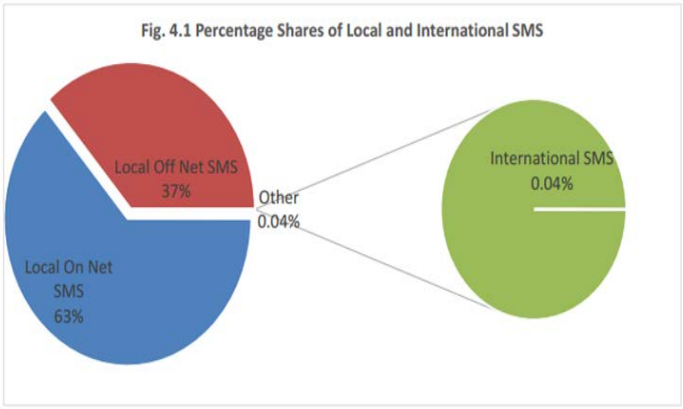


Figure 12: SMS Volume and percentage rates. Source: TCRA quarterly communications statistics report, January-March 2016 Quarter

3.3.1. Telecommunications Infrastructures in Arusha and in the Lake Zone

There is significant potential for future growth of the ICT infrastructure, which is critical since it can be the trigger to promote some important socio-economic changes, including in agriculture and specifically livestock producers. However, the Tanzania mainland presently contains significant asymmetries, with a major urban/rural divide. The divide is visible between Arusha region and the Lake Zone; the first emerges poorer than the second in access to mobile communications.

The number of towers, and naturally the amount of information present in both regions are substantially different. Making use of information made available by Helios Tower Africa[30], it is possible to illustrate the divide from the numbers of towers available in the two regions. For instance, it possible to see (fig. 13, 14 and 15) the high level of towers concentration in two of main regions of the Lake Zone – (Mwanza: 200 (fig. 13), Shinyanga: 98 (fig. 14), which confirms the disparity when compared with Arusha region (fig. 15), whose total number is 205, and the concentration of towers in the Lake Zone helps to illustrate the divide between rural and urban, which is easily observable.

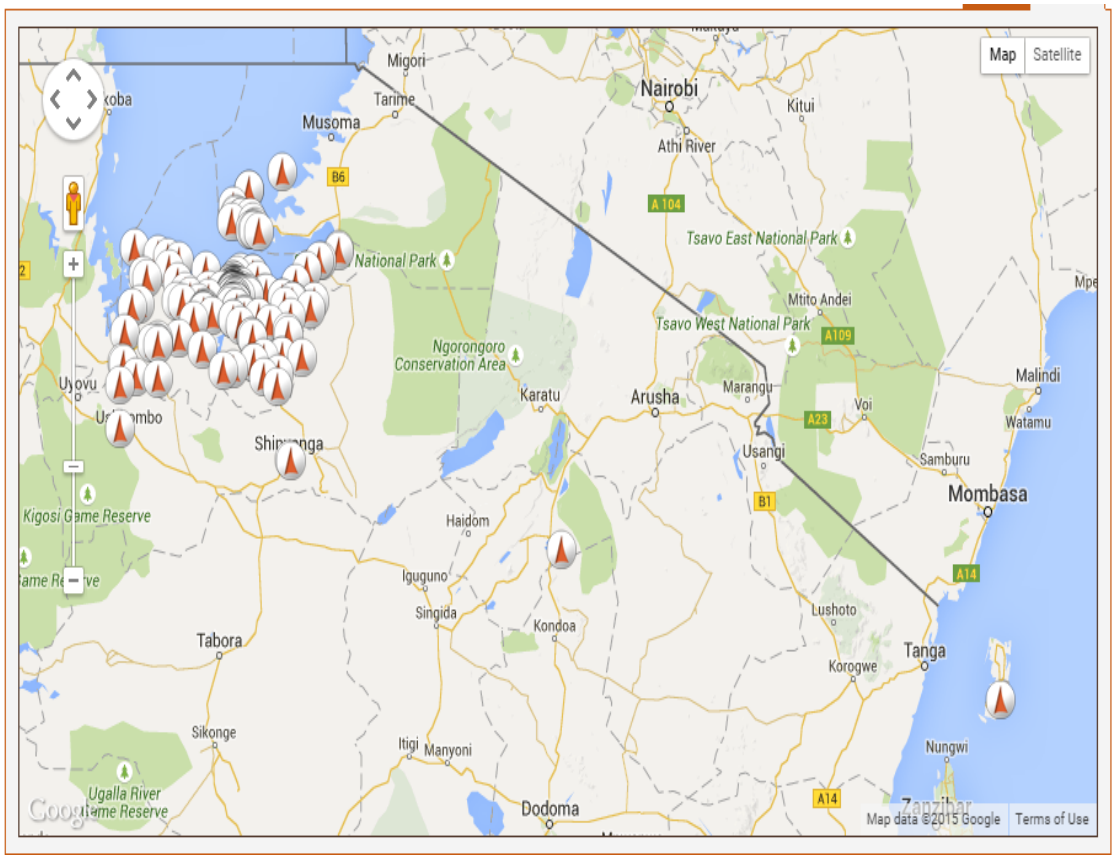


Figure 13: Concentration of towers (200 units) in Mwanza region / Source Helios Towers Tanzania[31]

[30] The leading telecommunications services provider, and one of Africa's most extensive tower networks proprietors, with more than 4,800 towers over three markets – Tanzania, Ghana and DRC

[31] https://www.httanzania.com/TowerSearch/SearchResults.aspx?city=mwanza, accessed on 04/ 08/ 2015

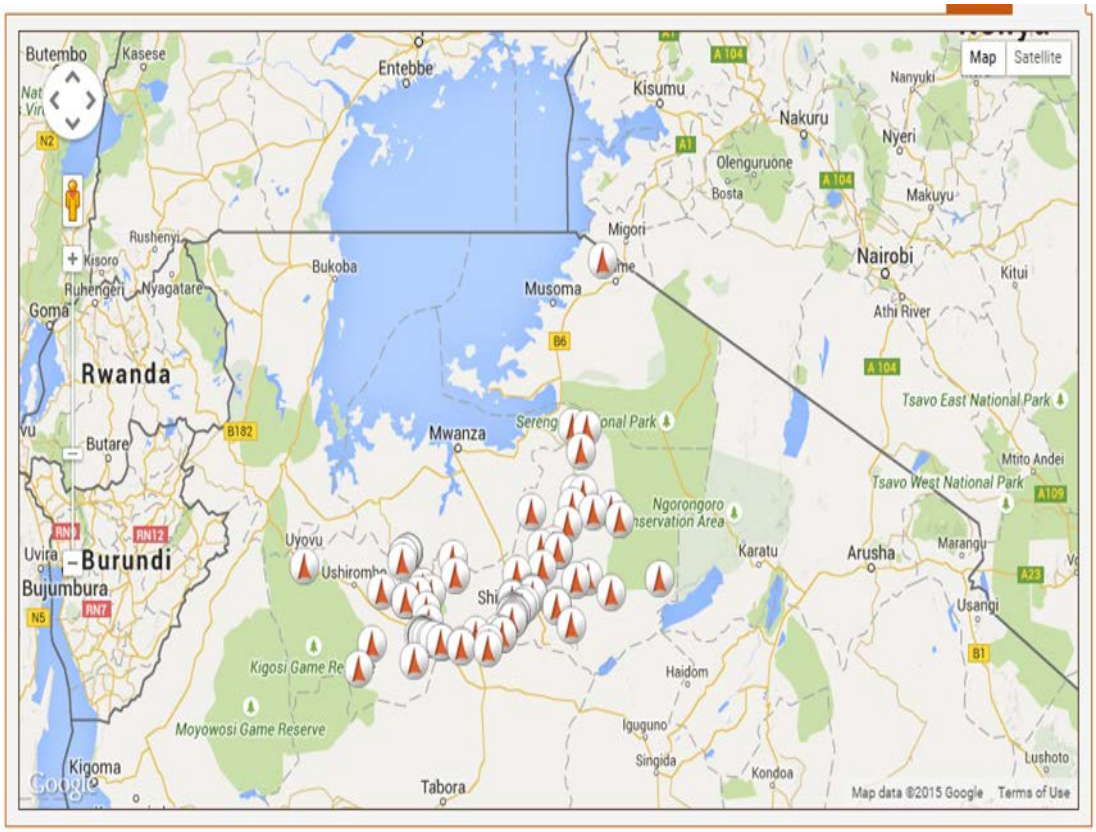


Figure 14: Concentration of towers (98 units) in Shinyanga / Source Helios Towers Tanzania[32]

It is possible to see this stark urban/rural divide from the data from Arusha. A total of 205 towers exist, 202 of which are in urban locations and only 3 in rural ones (fig. 15, next page). In Loliondo Division, the heart of the Maasailand and where livestock production and trade are significant there are only 3 towers. There are also significant differences in the technical structure of the towers, where it is possible again to find an urban/rural divide present. Urban towers have a far superior level of saturation than the rural tower, so, technically, their saturation point should, in normal circumstances, be achieved much later than the rural tower[33]. Notwithstanding those technical differences, demographic figures in urban areas explain why the saturation level is reached so quickly in urban areas. It is hard to get a good quality of mobile communications signal in the rural areas.

[32] https://www.httanzania.com/TowerSearch/SearchResults.aspx?city=shinyanga, accessed on 04.08.2015

[33] Interview with Dr Emmanuel Manassen, Lecturer in Electronics and Communications, Nelson Mandela Institution for Science and Technology, Arusha, 28th August 2014

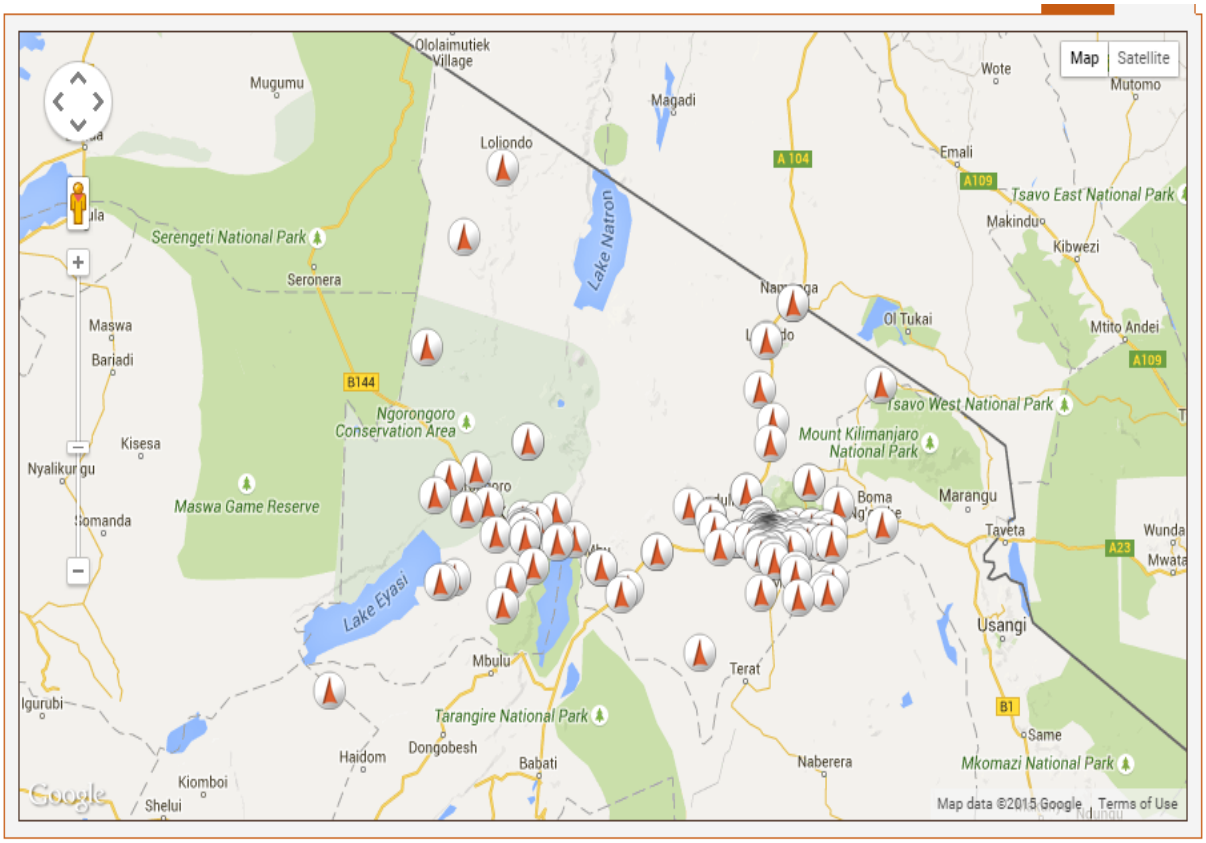


Figure 15 - Concentration of towers (205 units) in Arusha Region – Source: Helios Towers Tanzania[34]

[34] https://www.httanzania.com/TowerSearch/SearchResults.aspx?city=arusha&country=tanzania, accessed on 04.08.2015

3.4. Concluding remarks

The two fieldwork locations differ in various respects, though both are important parts of the Tanzanian economy. Both are major livestock producers, and in both I see that mobile communications have been rapidly introduced over the last years. There is a significant difference in livestock production: in Arusha, the Maasai are closer to being pure pastoralists, with less diverse agricultural resources. They do, however, increasingly take part in other economic activities in the region and beyond. In Lake Zone, the Wasukuma are agro-pastoralists, combining livestock production together with a wide range of other agricultural activities. In Arusha, pastoral production is rather weakly linked to other productive activity, whilst in Lake Zone the socio-economy is denser and more diversified. Analysis of mobile towers distribution shows that they are heavily concentrated in urban areas, further accentuating the difference between the pastoral heartlands of Lake Zone and the pastoral production districts of Arusha. These background data allow the analysis of the implications of differentiated mobile phone appropriation in the two fieldwork locations.

Chapter 4 – Analytical framework: understanding the relationship between technology and society

4.1. Introduction

This literature review aims to set the theoretical background and to build the analytical framework for this study. My aim is to set up a reflection regarding the technology-society relationship, and particularly to shed light on processes of technological change in developing countries. I seek to contribute to debates surrounding the concept of ICT4D, by theorising the multiple factors influencing the trajectory of the change based on ICTs in those contexts.

The chapter falls into six main sections: after this brief introduction, I present critiques of technological determinism (4.2.) which brought new approaches to the field, such as the so-called new sociology of technology (4.2.1.), and the Social Shaping of Technology (SST) perspective (4.3.). I review developments within the SST framework from SST Mark 1 (MK1) which emphasizes how technology is shaped by its historical context, to SST Mark II (MK2) (4.3.1.) which highlights the active role played by diverse intermediaries and users, i.e. through the social learning of technology framework. Section 4.4. focuses on a particular technology: Information and Communication Technologies (ICTs) and the prevalent narratives around discourses of development and modernisation. Section 4.5. reviews the development of the ICT4D framework and programmes. It highlights my concerns with initial conceptions of ICT4D (0.0), which will open up a space to reflect upon those, and more recent perspectives (ICT4D 2.0). In section 4.6. I introduce my analytical framework and in section 4.7. I will summarise the chapter.

4.2. Technological Determinism and the Linear Model revisited

The topic of Science and Technology (S&T) has been the focus of several disciplines. I can point to literature in the fields of Sociology of Science (SS), History of Technology (HT), Science and Technology (ST), Technology Studies (TS),

Information Systems (IS), Development Informatics (DI), and Media and Cultural Studies (MCS), which has been trying to reveal the role of S&T in society at different levels: economic, political and organisational. Rürup (1974, p. 186) suggested that when "we talk about the relationship between science and technology we are dealing, not with a one-sided one, but rather with a complex system of interrelationships which are, moreover, in a state of constant change [therefore producing many, and different, accounts.]".

In setting up my analytical framework I believe it to be important to revisit some relevant work done in the field of S&T and to highlight important aspects regarding the Social Shaping of Technology which antagonises Technological Determinism (TD). Therefore, depicting the role of technology in society suggests the need to use theories, concepts and explanations emerging from different fields, to try and deconstruct the "widely-held common sense belief (often referred to as technological determinism) which holds that technical change is a prime cause of social change, and that technical innovations are themselves 'uncaused'" (Edge, 1988, p. 1).

With regards to the TD perspective, Bimber (1990, p. 333) suggests that the approach may "[employ] different theoretical assumptions and explanatory approaches which are often not made explicit" which increases the chance for some of the complexities of technological innovation and change to be concealed. Layton, (1978, pp. 61-87) described this as the "*black box[ing]"* process, which corresponds to an attempt of (non)explanation of some critical aspects of the functionalities inherent to any technological device. This has led to the generalisation that technology is complex, leaving those clarifications enclosed under the warranty that it works.

The above claim leaves the terrain very messy in my view and makes it even harder to clarify which is the most profitable way to understand the technology-society relationship, mainly with regards to the direction of the technological evolution. Heilbroner (1967) argues in favour of a sequential path (frequently unidirectional) and underlined that some important moments of our modern history were strongly influenced by a given technology, for instance the steam engine played an important role during the industrial revolution in England, which has given birth to machine tools and to factories. However, this sequential portrayal of technology development paths

is frequently unidirectional and flowing in a top-down direction – a relationship that is known in much of the literature in innovation studies as the 'linear model' (Edgerton, 2004; Kline & Rosenberg, 1986; Landau & Rosenberg, 1986; Rothwell, 1992), which has "postulated that innovation starts with basic research, is followed by applied research and development, and ends with production and diffusion" (Godin, 2006, p. 639) and not taking into consideration factors such as the context of adoption and use. The critique of TD and related linear models of innovation opens up the debate regarding the "*black boxing*" of innovation. The critique insists that innovation should not be taken for granted or seen as an inevitable consequence of a linear trajectory of technological advance; rather, it should be seen as the outcome of the interaction between a range of political, social and economic factors that shape the development trajectory (MacKenzie & Wajcman, 1985). The SST perspective suggests analysing the context and the role of the user when exploring the generic functionalities of some technologies. For instance, concerning the mobile phone. Ling & Lai (2016, p. 834) suggest that the generic function "is to make us individually available to one another, thus facilitating coordination. Indeed, they afford us constant and ubiquitous connectivity", which offers users an opportunity for intervention mainly when those devices offer scope (openness/flexibility) for action. The mobile phone is a good example, whose appropriation enables access to a wide range of functions and situations, thereby increasing the opportunity for improvements.

4.2.1. The new sociology of technology

The decade of the 1980s was prolific in the theorisation of the relationship technology/society and brought to the field new perspectives to assess that relation, namely through new understandings developed by the Social Construction of Technological Systems (SCOT), Actor Network Theory (ANT) and Social Shaping of Technology (SST). I will now review those perspectives, and later in the chapter focus upon the SST which will provide key concepts to build the framework for my analysis. The enterprise of criticizing TD has opened up a broad debate and set the scene for these various traditions (SCOT and ANT) to produce work in the field of STS, aiming to further the TD's narrow perspective, being those claimed to be the new sociology of technology. Nevertheless, they seemed also to have failed to produce a substantive

work regarding the relationship technology-society. For instance, Pinch and Bijker (1984) when grounding their perspective (SCOT) in the possibility of a symmetrical explanation for failure and success, seemed not to have grasped fully the central argument of the Empirical Programme of Relativism (EPOR), the epistemological ground where they support their perspective (Russel, 1986, p. 334).

Concepts deriving from SCOT were introduced and generated the ground for new debates, which not only attempted to expose the wrongness of TD but searched for new directions to explain the interdependent set of factors determining the relationship technology-society. For instance, SCOT researchers suggested "*interpretative flexibility*" (Pinch & Bijker, 1984) as a new way to conceptualise that relationship and pointed to an active role of particular groups in adopting a given technology, pointing out how flexibility can be reduced in order to allow for the stabilisation of the innovation. The proposed mechanism is supported by the user (or group of users) activity and the particular strategies which they use to overcome their struggles, i.e., making the problem to disappear.

Those were called the mechanisms of closure, which assumes different forms, and I will point to two of them: **i)** the **rhetorical closure** – which is achieved by closing the controversy i.e. "*one need not solve the problems in the common sense of that word"*. The key point is whether the relevant social groups see the problem as being solved" (Bijker, Hughes, & Pinch, 1987, p. 44), and **ii) closure by redefinition of the problem** (idem), which presupposes shifting the emphasis from one hypothetical problem affecting one group of users to a factual solution sorting out the problems of another particular group using the same technology.

Those perspectives can eventually help to support the critique of TD, but they also open up space for further debate. Russell (1986, p. 334) suggested that "only by scrutinizing the whole process, demonstrating and explaining the different points of access of each group to it, can we both expose deterministic myths and explain their plausibility in specific circumstances", and this clearly bring us into the SST terrain.

4.3. The Social Shaping of Technology

After more than three decades of empirically informed research, the field has brought together many and different approaches from the social sciences, especially from the history of technology and the sociology of scientific knowledge. The social shaping of technology has evolved under the idea that: “developments in the era of distributed computing have begun to transform the relationship between systems design and implementation (and between designers and users) - in which some elements of technological design and supply […] have moved closer to the user organisation and the 'end-user' of particular systems.” (Williams, 1997, p. 14). This fruitful work gave the opportunity for a sort of reconciliation between early approaches to be set up, based on the “willingness to learn from other frameworks which assume the malleable nature of technology and analyse the forces influencing its direction, and a borrowing from other areas of study concepts and insights which can be made consistent with their principles” (Russell & Williams, 2002, p. 37), being thus the key strand of the SST, once:

> *“Central to SST is the concept that there are ‘choices’ (though not necessarily conscious choices) inherent in both the design on individual artefact and systems, and in the direction or trajectory of innovation programmes. If technology does not emerge from the unfolding of a predetermined logic or a single determinant, then innovation is a ‘garden of forking paths’. Different routes are available, potentially leading to different technological outcomes” (Williams & Edge, 1996, p. 2).*

Consequently, this interdisciplinary and multidirectional perspective of understanding technology in society has enlarged the gulf between opponents (SST scholars) and the proponents of the TD, and as well as the gulf between SST and SCOT/ANT (Russell & Williams, 2002) those being the key schools of analysis of technology in society. However, the major fracture is found between the ones emphasizing an interdependent set of factors and actors influencing the process (SST), and the others stressing the autonomous character of the technology (TD), with the former suggesting that analysis is required as to how those options are actively adopted and integrated by key actors in their context of use.

Hughes (1985) argued in favour of a systemic approach in the shaping of technology, using the example of Edison and the electric lamp to illustrate the myriad of actors and social factors that were involved in that innovation process and the long time span that

gave form to the development of one electric light system, giving the context (demand + economic factors) an important role in the trajectory and development of that innovation process, as emphasized by Hughes: "[Edison] conceived of the problem to be solved by invention as inseparably technically and economic" (idem, p.29*)*, which gives me reasons for also not conceiving technological innovation without the myriad of social actors and factors that influence its trajectory and outcomes.

The central idea enclosed in previous sections suggests returning for a short moment to the initial topic of this chapter, i.e. the technological determinism, since it has been recurrent in choices regarding design and implementation of the technology, i.e. the significance and politics of the artefact to be fixed in laboratories and/or offices, where the technology is designed and both the scripting and black boxing processes are done. Regarding the design, it is claimed that a "large part of the work of innovators is that of "inscribing" the vision (or prediction) of the world in the technical content of the new object […being] the end product of this work [what has been defined as] a "script" or a "scenario" (Akrich, 1992, p. 208). Therefore, I believe that it is crucial to rethink the design process, and to produce new conceptualisations of both the user and the context, i.e. "a space that holds together the settings and relations" (Jorgensen & Sorensen, 1999, p. 410) which encompasses the need to generate a closer perspective of the complex and interdependent network of actors and factors that in particular circumstances constraint or facilitate their activities. These are subject to be the "configuration of the user", a strategy which relies on being able to "define, enable and constrain" (Grint & Woolgar, 2013 [2007], p. 74) the users' future experience when using the technology.

This was suggested to be the design-centred perspective, which has emerged as a movement to prevent the black boxing of the technology. Conceptualisations about the design-centred model have been pointed out as an important factor determining mismatches with regard to the designer's priorities and the user's needs (Stewart & Williams, 2005), processes that increase difficulties in interpreting scripts and consequently opening the black box, a method that relies on the capacity to decode the 'blueprint' encrypted in the artefact. This process often forces users to be creative and to (re)invent new uses and practices when the design is presented as unfinished, or with a degree of openness to support their actions, and therefore enabling the

(re)configuration (Geels, 2002) or a "creative reconfiguration" (Agarwal, 2017). When this is not possible, the scope for appropriation becomes shallow. The above corresponds with what has been interpreted as "the design fallacy" (Stewart & Williams, 2005, p. 195), which emphasizes an "essentialist position" (Wajcman, 1991, p. 25) in technological development, which consists in imprinting in the technology a wrong set of social values. This offers an opportunity to take this perspective further, and to underline that those social values are also expressed in ways "in which the design of the artefact is a more or less simple reflection of the values and priorities of designers and developers" (Stewart & Williams, 2005, p. 196). This perspective encompasses a narrow understanding of the user's requirements, namely when interpreting them as passive recipients of designers, which suggests moving to a focus on some important aspect about matters of choice of design and implementation of technology.

The above topic, besides SST, is also addressed by a specific body of literature (Business & Marketing and Organisational Theory), where the need is stressed for shifting the emphasis from the initial focus on the design of technology to give weight to the users and context (Abowd et al., 1999; Dey, 2001; Schilit & Theimer, 1994), i.e. "the setting in which action unfolds" (Dourish, 2004). I interpret this as an attempt to redefine the scope of action of the SST, moving from MK1 to MK2. The need to centre the process of change on the context of use and on the user's requirements, i.e. to fit the technology into their context of action, i.e. taking into consideration the territorial location of each group, which implies assessing the sociotechnical resources and tacit knowledge embedded in each group of users, aiming to "[enact] a set of social practices, which reinforce, adjust, or change the existing institutional properties (Orlikowski, Yates, Okamura & Fujimoto 1995. p.423). This is a relevant aspect of this turnover, where the empirical research undertaken by many SST scholars has sought to place emphasis on a new perspective in order to understand the technology-society relationship, namely when engaging in analysing how the users are represented in different stages of technological development (design & implementation). With regards to this perspective, Stewart and Williams (2005, p. 197) suggest that the:

> *"'design problem' is then conceived in terms of the failings of design practitioners – through ignorance of users (their purposes and contexts) or their commitment to different priorities – embedding the wrong values/specification of user requirements in*

> *design, with imputed serious negative consequence for the usability and use of those artefacts for particular purposes and by particular groups."*

This is claimed to represent to some extent a form of TD and gives the opportunity to illustrate the importance of the user's requirements in order not to fall into the "design fallacy" (idem. p 199). This is supported in the misconception that it is necessary to extend both knowledge and contexts of use to a level of complexity that itself would become a shortcoming in the enterprise of decoding the script. Consequently, it would make the reconfiguration difficult and therefore decrease the chances of appropriation.

As such, it can be argued that the possibility of the user reconfiguring the technology is one possible solution for avoiding the impact of technological "black boxing", since implicit in the rationale behind this line of thought is the notion that none of those technological innovations would evolve without adoption and use. i.e. without being *innofused* (Fleck, 1988a, 1988b, 1993) and without the gradual expansion of knowledge (both conceptual and practical) and acceptance of the social forces. Those will define how a given technology will be consumed, namely in:

> *"[...] households and in the established patterns of everyday life. These will define in large degree how a particular technology will be used and, at least in part, also the consequences of that use. The emerging character of a new technology, as well as the established character of an old one, will depend on the constantly shifting relationship of actors and structures in both these domains." (Silverstone. & Haddon, 1996, p. not paged)*

This invite us to look at society as geared in a co-evolutionary path (Geels, 2005; Rip & Kemp, 1998), where both technology and social forces evolve simultaneously and shape each other, and that will determine the conditions for change and development to take place, i.e. technology will need to be reconfigured (socially shaped) before they can made be useful, making it indispensable to revisit the concept of affordance (Gibson, 1979; Norman, 1988), when developing my analytical framework (section 4.5.3.1. – Analytical Framework) in order to build my arguments, considering that the "values and meanings of the things in the environment can be directly perceived" (Gibson, 1979, p. 119), i.e. "what we perceive when we look at objects are their affordances, not their qualities" (Gibson, 1979, p. 126) because those normally will generate "preconditions for an activity"(Pozzi, Pigni, & Vitari, 2014, p. 2). As noted above, I will develop this discussion later.

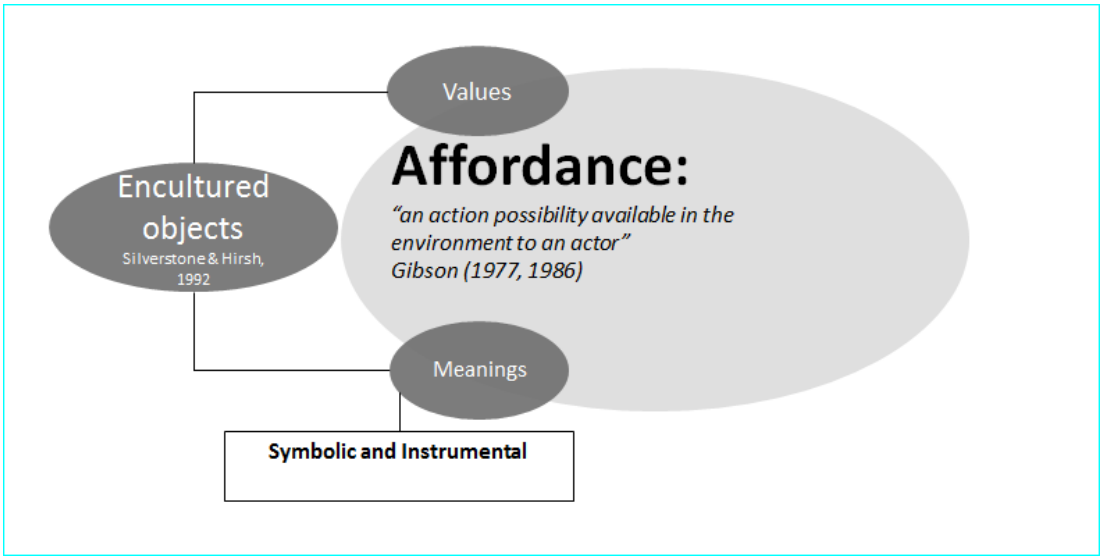


Figure 16 – Depicting the Affordance mechanism: the first element of my analytical framework.

Consequently, this suggests me to be attentive to how the actors to be investigated perceived the mobile phone and how they disclose hypothetical affordances of the mobile phone in order to integrate the device into their day to day activities. In this aspect, I imagined those actors "acting [differently] on the perceived opportunity for action" (Pozzi et al., 2014, p. 3) made available by mobile phones, taking into consideration that there are conceivable differences in the sociotechnical potential of each of the regions.

Figure 16 (above) represents one of the three segments of my analytical framework and it aims to depict a scheme through which the objects existing in the material world are encultured in different contexts. In this scheme I present the enculturation process as an active process of ascertaining the essence of the technology, i.e. an activity that consists in permanently assessing its symbolic and instrumental character, e.g. '*what this means to me*' and '*what can I do with this*'. This dialectical relation is done by placing the object at the core and confronting it with both values (norms and codes) and meanings (tacit and local knowledge) grounded in a particular context. Those will not only constitute mechanisms to allow for the interpretation of the object but, fundamentally to reinterpret the context, in the light of the possibilities made available by its symbolic or instrumental character and consequently identify (when opening the black box) what the thing can afford, allowing one to intervene in the context and

shaping it in accordance with one needs and wants. This will generate a dynamic between the activity of disclosing affordances and the appropriation process, as the two emerges as the two sides of the same coin, i.e. the more affordances one is able to disclose the more one will be able to appropriate the thing, generating a spiral of energy which will open opportunities for more affordances to be disclosed, therefore extending the appropriation.

Consequently, and now narrowing this down to my research, and shedding light upon attempts to use Western technologies in many of the developing countries with the aim of promoting development, it is then possible to point out some crucial gaps. For instance, some explanations for those gaps can be found in the persisting use of strategies anchored in more essentialist perspectives which are preventing the S&T outcome of being more effective in solving many of the problems, which they target in those countries. One good example being the lack of assessment regarding the user's role. This has been claimed to undermine some promising results, and the literature in the field of technology studies (Sørensen, 1996) and of information systems (Foster & Heeks, 2013b) have addressed this issue by looking at the role played by designers and users, and have claimed that the absence of the users' visions in different stages of innovation/production, especially design, will make the process of reconfiguration more difficult and consequently the process of "innovation less efficient."(Sørensen, 1996, p. 2). With regards to the users, it is claimed that there is a need to improve "'users' capabilities to employ […] a given set of machinery[/technology]" (Sørensen, 1996, p. 3), which requires the assessment of their need at upstream (Geroski, 2000).

Extrapolating, the above can be interpreted as a new understanding of the relationship technology-society, and therefore determining the direction of change, which I think consists in the convergence of those different world visions. Reinforcing, I suggest that technological change should be perceived as the outcome of a process of negotiation and renegotiation, placing users at the centre and having an active role in this process, i.e.: "[…] to make an artefact work, it has to be placed, spatially, temporally, and conceptually [in the context of use] " (Sørensen, 1996b). Reflecting on this, I can conclude that this convergence can be best achieved if it is enhanced by analysis of socioeconomic and political spheres (design, production, and

commercialisation) that should enable conditions for the social learning of technology, which encompasses a broad perspective where both "users and designers learn, but not necessarily from each other. Individuals learn, but so do institutions and societies" (Sørensen, 1996, p. 3). This more encompassing perspective should enable conditions for unfolding the content of enclosed "scripts" which propitiate conditions for users to reconfigure technology according to their needs, which will increase the changes for them to appropriate it, as I will be describing later in this chapter when introducing my analytical framework (section 4.5.3.1.).

The above requires designers to bear in mind the set of values, attitudes and availability of resources (technical infrastructure and know-how for instance) immersed in the context of use, and to try to anticipate. One of the possible strategies is to include the feedback of user experience in the design or policy making stage: (e.g. "*design-actuality gap*" as proposed by Heeks) which consists in including the perceived strategies that the user will be using to open the "*black box*." This constitutes a relevant aspect in the SST turnover from MK1 to MK2, which has pushed scholars affiliated to this cohort to place more emphasis on the users' requirements. This is one important aspect of the SST new perspective (MK2), since "what may be digested from the various learning processes [will have] a decisive influence on the development of technology" (Sørensen, 1996, p. 5), therefore reinforcing the SST initial perspective (MK1), which has previously argued that there is a broad set of social factors interacting and influencing the relationship technology-society.

4.3.1. The SST turn: from mark 1(MK1) to mark 2 (MK2)

Moving forward, it is important to bear in mind all that is said in what follows, the purpose of which is to ground this narrative in two key moments of the chronology and evolution of the SST, i.e. the 'turn' from MK1 (the critique of TD and emphasis on the impacts) to MK2, which pays a great deal of attention to users, meaning, and uses of technology. Therefore, my approach, which finds echo in some of the work of Heeks, adopts a model that can be placed at the SST MK 2 level, since it seeks to attend to **i)** the active role of the users in innovation, and **ii)** technology as a heterogeneous assemblage which is permanently being reconfigured by users. This I

believe to be an important aspect of the new wave of social analysis conducted by some SST researchers, mainly when putting emphasis on the possibilities enclosed in the artefact and in the strategy used by local users to disclose its affordances. This, it is expected, will improve the conditions for understanding dynamic, interplay and social negotiation in translating visions or implementing, sociotechnical changes, i.e. the social learning experience (Rip, 1995; Sørensen, 1996; R. Williams, Slack, & Stewart, 2000; Wynne, 1995) and therefore:

> *"broaden the intellectual base of SST and […] clarify opportunities for intervention. [In this line of reasoning I] sought to explore these concerns in particular domains [such as] the domestication and appropriation concepts […] to carry forward some aspects of SST and address earlier weaknesses" (Williams et al., 2005, p. 45 and 48).*

Consequently, I can point this out as being a key shift, which has driven SST to its current stage, (SST MK 2), extending analyses of the user participation in earlier stages of technological production, such as design and development, which suggests placing a good deal of attention on the role interpreted by users and as well as in the context of use (Heeks, 2002; Stewart & Williams, 2005). With regards to this, von Hippel (2001, p. 82) suggests that today's "user innovation communities are making that idea increasingly real. Open-source software projects, among others, have led to innovation, development and consumption communities run completely by and for users. Such communities have a great advantage over the manufacturer-centred development systems" because they have a better knowledge of the context and it is this that makes them anticipate the needed affordances.

4.3.1.1. User as actor in the Social Learning of Technology: *domestication*, *appropriation and technology affordances*

As discussed previously, I have identified two key issues in understanding how technological innovations are adopted and made available for use: the user feedback with regards to the design and implementation processes, and the 'context of action' which is different in time and space. That suggests using the concept of *appropriation* as a building block of my analytical framework, which will be reinforced with the ICT4D 2.0 perspective, expecting that this can lead me in the "combined act of discovery and analysis, [and] understanding [how] artefact work, [in] the existing, heterogeneous networks of machines, systems, routines, and culture" (Sørensen, 1996,

pp. 6-7). This suggests giving attention now to the SST turn, which has steered the analysis towards:

> *"[i] processes of acquisition and appropriation in specific contexts; [ii] the extent of innovation as technologies diffuse and are used; [iii] the relations and strategies of developers and users in shaping the locus and control of innovative activity; [iv] the articulation of supply and demand sides; [v] the connection between innovation and the public evaluation and political steering of technology."(Russel & Williams, 2002, p. 63)*

Consequently, it is important to flag that the *appropriation* concept emerges frequently intertwined with the concept of *domestication* in relevant literature, which suggests that I should try to differentiate them and clarify why I will use only the *appropriation* concept to explain the adoption process by the Maasai and Wasukuma livestock producers. As such, it is important to first explain what *domestication* is, before grounding this narrative in the *appropriation*. The concept of *domestication,* drawing on the idea of domestication of animals, was originally developed by Silverstone and Hirsch (1992) to explain how artefacts are integrated in the domestic setting. According to those authors, to domesticate corresponds to "the manner in which people convert things to ends of their own", therefore "locking the machine and its meaning into an existing technological culture of family and household" (Silverstone. & Haddon, 1996, p. not paged), mainly when trying to make sense of its moral economy and cultural meaning since there is present a certain degree of indeterminacy in the sphere of consumption, as not everyone consumes technology equally or with the same consequence (Silverstone & Hirsch, 1992, p. 5). This perspective was furthered by Sørensen (1996a, p. 10) when pointing out that "to domesticate an artefact is to negotiate its meaning and practice".

The above definitions of *domestication* differ slightly from the concept of *appropriation,* which "emphasises the active role of technology users and other local players, in interaction with supply-side players, in establishing new uses of technology and in creating new markets" (Williams et al., 2005, p. 7). This suggests a different level of knowledge of the technology itself and that users "appropriate it into [their] culture and expand its cultural meaning or value" (du Gay, 1997, p. 17) so that it can be used with different perspectives "ranging from individual engagement with an artefact to how a country reacts to the availability of a set of global technologies"

(Williams et al., 2005, p. 55). This is pointed out by Sørensen (1996, p.13) as the outcome of the social learning of technology process, stressing that "to do, is to know" and "to know, is to do" which suggests two levels of appropriation as I will be pointing out later. (Sørensen, 1996) proposes this as an approach to analyse and conceptualise the relationship between technology and society. The basis of this approach can be found in the so called "evolutionary models" (idem, p.1) suggesting that the idea beyond this new analytical framework is "the combination of the processes of the production of new variations through "hybridization" or "mutation" and selection (idem, p.2).

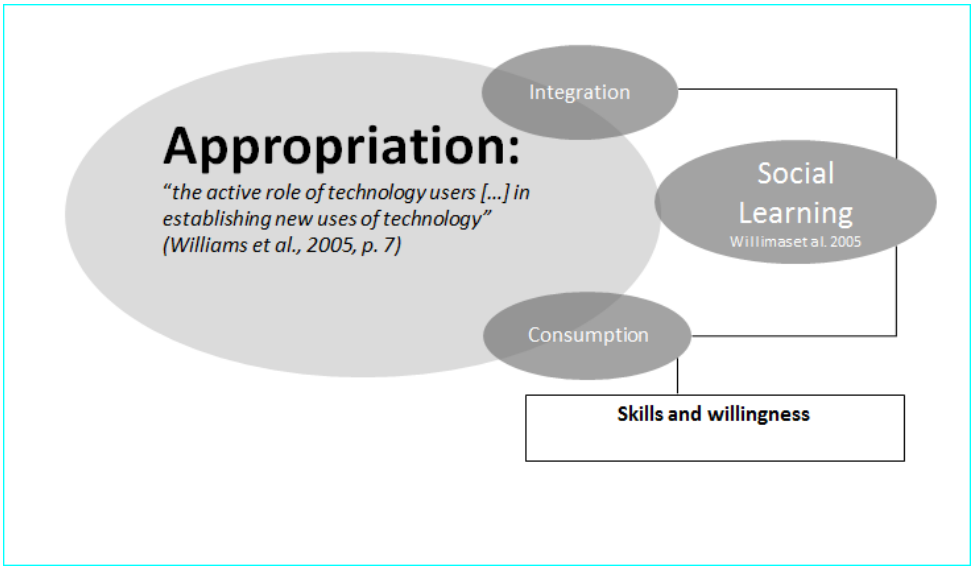


Figure 17 – Depicting the Appropriation mechanism: the second element of my analytical framework

Focusing now on the second element of the analytical framework (the appropriation process illustrated above), I suggest pay attention to the active role played by users, namely when making use of their adaptive and reflexive capabilities. In this process, skills and willingness emerges not only as internal catalysers of the mechanism of appropriation but, as well as, the external catalyst that enables the affordance procedure to take place in this sort of feedback loop. They function at two dimensions: internally (endogenous mechanism of appropriation) and externally (as an exogenous mechanism which favours the device affordances to be disclosed). This process can happen in a non-causality dialectic, i.e. merely as the need of one having to sort out the constraints existing in the material world, or it can happen by induction, suggesting

suppliers, designers and policy-makers to enable conditions for the social learning of technology process to occur. This will enable the users to better understand technology value and meaning and dictate the level of integration and consumption and re-centring themselves from forced detours (dependencies). As such, we cannot conceive appropriation as independent of the affordance process. Those two will appear always as the two faces of the same coin and they will overlap and generate feedback loops which cause-effect is the third segment of my analytical framework as we will see further ahead.

This suggests paying attention to mechanisms such as "learning by doing" because "learning can only take place through the attempt to solve a problem and therefore only takes place during activity (Arrow, 1962, p. 155). This suggests that the inventor/ innovator will have to learn about the real needs of the context of use and make "easily enough some recombinations of elements" (Sørensen, 1996, p. 2), i.e.: making it easy to decode the blueprint of the technology, as I have been arguing. So, to make the affordances of a specific technology clearly visible through the eyes of the target user it is necessary to learn how to understand "the ways artefacts and systems are culturally appropriated and made part of (or rejected by) a given social system […], they will need to learn how to "re-embody" and "re-embed" (idem, ibidem).

Sørensen points out that the "main idea to focus on social learning is to provide both a critical and a constructive input to technology policy" (idem, ibidem), and try to anticipate limitations that will prevent diffusion of marketable innovation by addressing classic strategies that have made "users becomes secondary, which is problematic for two reasons. First, it makes innovation less efficient. Second, it produces technologies that are not adjusted to users' demands and on occasion may run counter to users' needs or even may be harmful to them" (idem, ibidem).

Hirsch & Morley (1992) and Williams et al. (2005) point out that both domestication and appropriation have been used more or less interchangeably in order to analyse how artefacts are integrated into social life. Nevertheless, and because I found a degree of resonance, I chose to use just the idea of appropriation, since this is pointed out (Sorensen, 1996, p. 13) as a way to conceptualise the struggle with "the socio-material relationships". As such, when enhancing my analytical framework with the

appropriation concept, I believe extending Williams et al.'s observations, and favouring conditions to: "understand processes of socio-technical change, as also a process of negotiation and interaction between different players and thus subject to conflicts, and differences of power and interest" (2005, p. 49).

Those are the reasons for grounding my analyses in the appropriation concept, which implicitly suggests the possibility of the user reconfiguring the fact/artefact, involving "experimentation, learning processes [and] adjustments […] (Geels, 2002, p. 1271). This, I would say, emerges as the core of the SST MK2, and represents a key shift from the earlier perspective (SST MK1) when demonstrating that users play an important role when appropriating technologies.

In grounding my approach at SST mark II, I look to being able also to flag relevant debates taking place in what concerns technology adoption, namely reinforcing the critique by social shapers during MK1, whose position is opposed to the TD idea that technology "moulds societies to suit its needs" (Russell & Williams, 2002, p. 36), i.e. it criticizes the predominance of an essentialist model of technology production, namely at the design stage, where an "heroic view of design [is presented] as successfully embedding a range of explicit purposes and implicit values" (Stewart & Williams, 2005, p. 195). The same authors argue that there is need for an "alternative view of the role of design in the development of new technologies" (idem, ibidem), emphasizing the need for developers to shift the strategy and ground it in a perspective where technology is perceived as "unfinished in relation to complex heterogeneous and evolving user requirements" (ibidem). Supported by the above arguments, I would say that the user and the context of action emerges at the core of the social learning of technology. As said previously, this is an important shift in the chronology and evolution of the SST, mainly because it is suggested a new perspective to assess the technology-society, which is grounded in a more complex and multidisciplinary approach, e.g. the inquiry regarding the adoption and use of technology, either by individuals or organisations, is now done empirically and in a more informed manner and placing a good deal of attention to the context of action, assuming as crucial the existing differences, in what concerns priorities and goals, between those two actors (individuals and organisations), which makes the purposes, when adopting technology, to be different.

If we give attention to different users groups, we will see that their experience will vary according to their power to choose and make a decision, and also when acquiring the necessary skills and authority to use S&T outputs in different ways and at different levels, but most importantly how they interpret the option made available and how they influence the evaluation process (Russel & Williams, 2002, pp. 64-65).

Therefore, my analyses will be supported by the concepts of *appropriation* and *affordances.* To those two I will add one third concept that emerges as a key enabler and as the outcome of the interaction between the two first concepts. I am refereeing to the concept of *resilience*, which has gaining currency in social studies. In section 4.5.3. I will clarify what the concept is and how it will be used to inform this investigation. In doing so I expect to be able to conceptualise the ongoing change and to gain a better understanding of the ways in which artefacts and systems are culturally appropriated (du Gay, 1997) and "made part of (or rejected by) of a given social system" (Sorensen, 1996, p.2). This will be laid down in a more systematic way in the section 4.6., where I will introduce my analytical framework and illustrate how those three concepts will interplay and inform this research. In developing this framework, I expect to be able to generate a more SST grounded analysis, which will increase the possibilities of capturing the essence of the mobile phone appropriation by the Maasai and Wasukuma livestock producers and explaining how this device is influencing production and marketing dynamics. This constitutes just a snapshot of the dynamics of appropriation, which, as said, will be discussed in the light of the empirical findings in chapter 10.

4.4. *Development discourses and ICTs*

ICTs are frequently pinpointed as relevant tools for addressing the problems of development. The South emerges in some literature as ill-equipped to develop, or to take benefit from science and technology. It is suggested that most countries in the south are deprived of basic resources and knowledge, which widens the existing north/south divide considering the lack of "**(i)** capital goods […] **(ii)** professionally skilled people, in particular scientists, engineers and technicians, **(iii)** R&D personal and R&D investment" (Bhagavan, 2016 [1997], p. 3), which means that more

investment is needed for those low-income nations in order to catapult development, and this all together forms a sort of rhetoric regarding developing countries.

These debates in science and technology studies have been partly linked to another set of debates about how science and technology might be deployed to promote development in less developed countries (LDCs). We can trace these discourses back to the 1970s and the emergence of theories and a set of programmes to help low-income nations to develop. Tracking this back will take us for instance to Modernization Theory (Armer & Katsillis, 2001, p. 239; Giddens, 1987, p. 177; Rostow, 1960) which emphasized that the current state of affairs of LDC is due to lack of industrialization and prescribed a cultural and industrial adjustment to help LDCs move through some of the important stages of industrialisation as a solution to tackle underdevelopment and poverty. That strategy was firmly criticised by an alternative theory of development – Dependency Theory – which argued that the LDCs became more impoverished as a direct result of their trade relations with the industrialized countries (Cardoso, 1977; Prebisch, 1962; Singer, 1949).

Modernization theories claim that to promote development in those nations then there is a need to accelerate along a similar path used in the past by industrialised nations, a claim that is criticized by dependency theorists on the grounds that less developed countries have particular characteristics that need to be addressed specifically and endogenously and with specific (and local) technologies (Pattnaik & Dhal, 2015, p. 95). Some promoters of modernisation theory suggest leapfrogging using foreign technology (technical fix), which would once more be criticized by dependency theorists on the grounds that developed countries technologies were not appropriate for LDCs. They suggest (Easterly, 2017) that the persisting use of policies and technological innovation developed in the West and exported to developing countries as technical fixes would not trigger local capacities and therefore would not contribute towards LDCs development – e.g. they were expensive and requiring skills and infrastructure that were scarce and expensive to create, and this would generate even more dependency, for instance through loans made available by the World Bank to set up those ambitious programmes of technological change, proposing:

> *"[…] rejecting prevailing perspectives that accepted as inevitable the division of the world into two groups of societies: those that engage with science and technology in a*

> *creative process that generates the technological bases of production and consumption; the others that merely use and apply some of the results of that creative process undertaken elsewhere. [Furthermore, the LDCs] should also be adapters, improvers and creators of the technologies they came to use in their development." (Ely & Bell, 2009, p. 6)*

For instance, the technological level of the recipient country is a key factor determining the success or failure of the knowledge, technology or innovation transfers process, "specifically, it has depended on the magnitude and character of the base in a modern industry and infrastructure that these regions inherited at decolonization." (Bhagavan, 2016 [1997], p. I). This suggests that I should also pay attention to the sociotechnical infrastructure existing in those two regions and analyse to what extent their capabilities will influence the dynamics of appropriation, not only as regards the mobile phone but also well as LINKS.

4.4.1. Appropriate/intermediate technology

The appropriate/intermediate technology movement emerges then as a sort of middle-ground perspective, holding that LDCs need to encompass technological choices that are locally adaptable, are more attuned to local skills, and have more autonomy in order to fit into the context of use to help and promote development. This would create conditions to leapfrog some developmental gaps in LDCs therefore making the first, and third world to become somehow closer, namely when using a technology:

> *"[…] which would range in some intermediate position between the £1-technology and the £1,000-technology. Let us call it – again symbolically speaking – a £100-technology […]. Such an intermediate technology would be immensely more productive than the indigenous technology (which is often in a condition of decay), but it would also be immensely cheaper than the sophisticated, high capital-intensive technology of modern industry." (Schumacher, 1973, pp. 148-149)*

A significant number of cases I have pointed to throughout this literature review would have better chances of generalisation and scalability if supported in this view. For instance, mobile phones' appropriation in LDCs have been helping to close some developmental gaps, which both modernisation and dependency theorists were far from predicting. There is a set of factors supporting (or forcing) the fast uptake of mobile phones, including the scarcity of technical infrastructure to support communication using landlines (Horst & Miller, 2006, p. 8). This is probably the most significant factor explaining the appropriation of mobile phones in LDCs. Other

factors include the rapidly falling cost of IT and fast-growing markets in newly industrialised countries. (Franzini & Pizzuti, 2000, pp. 159-161). The commercial value of mobile phones, which is still affordable for a large majority of micro-entrepreneurs, and the fact that the affordances that the mobile phone has inbuilt are not locally specific, increase the opportunities for acquisition and for them to be used in contexts where both the socioeconomic and sociotechnical infrastructures are deprived. Also, and because the device is not a very complex technology to use it makes it far more accessible to most of the users to appropriate (open up the black box) and adopt it in a bottom-up process. The simplicity of use, the autonomy, and the connectivity to the remote regions that it allows, are possibly some of the most significant affordance and factors dictating the expressive use of mobile phones throughout LDCs. As such, I can argue that those possibilities have increased the opportunities to identify resources, and mapping patterns for decision-making, and this in generic terms can help to explain how the device has been changing the South, mainly Africa, thus making it a good example of an appropriate/intermediate technology for supporting developmental strategies.

> *"These systems revolutionized communication in Tanzania as they have done elsewhere in the world. But, in Tanzania, this has been especially significant because there were virtually no other electronic means of communication—no "copper wire" phones, no faxes, very few computers, and therefore very little e-mail. Now, a Maasai man can speak to his son herding cattle 20 miles away. A doctor can call his hospital to alert them to an incoming patient. These phones have tied the nation together. While sitting around a campfire in the bush with Maasai warriors, it may look silly for someone's cellphone to ring, but mobile phones connect people to each other in dramatic ways"*[35] *(Mpogele, Usanga, & Tedre, 2008, p. 70).*

The above quote makes clear the potential of this technology with regards to adoption and use, which was already recognised in the mid-2000s. However, I believe that this is still not enough to explain some very important issues. There are questions at the level of business and market, and political strategy, which are important to bear in mind and to try to answer as well, not just for the Tanzania context, but mainly with regards to developing countries in general. For instance, and in a more strategic way, it seems important to ask what triggers are supporting the politico-economic decision of implementing a large sociotechnical infrastructure worth millions of pounds in

[35] http://empowertz.org/cell-phones-in-tanzania/, accessed on 20.04.2018

countries where in theory the chances for recovering the investment are poor or nil. This is noted in some literature (Levin & McEwan, 2000) as the cost-effectiveness challenges of implementation. Attempts to mitigate these problems has been done, for instance, through development of policies to take ICTs to rural areas, e.g. Telecommunications Development Funds (Wellenius, 2002, p. 5). For instance, concerning the use of mobile phones to deliver healthcare and information, it is claimed that "mHealth could offer solutions for healthcare systems challenged by inadequate finances, poor health information systems, scarce resources and limited trained staff, particularly in countries with a rapidly growing number of mobile phone subscriptions" (Aranda-Jan, Mohutsiwa-Dibe, & Loukanova, 2014). This means that the cost-effectiveness relation between building a healthcare facility and developing an infrastructure to support the use of mobile phones will tip more towards the latter than the former because it seems more efficient. My argument is supported on the perspective that it is always easier to promote services making use of resources already in use (appropriated) than to try promoting the full package (sociotechnical infrastructure + tools to access it). In what concerns this research we should take into consideration that the main tool (mobile phone) allowing access to the sociotechnical infrastructure has already being appropriated by the user and its use is relevant. This will ensure investors that its worth to build the infrastructure because the demand is real and is high? I believe that my findings will address some of those questions, and explain the mechanisms put in place to overcome constraints and the particularities of the Tanzanian context regarding the construction of mobile communications infrastructure, namely when pointing out the construction of the National ICT Broadband Backbone and the Go Rural project.

4.5. Information and Communication Technologies for Development (ICT4D)

Looking at the context of this study, the literature is suggesting the existence of a robust body of work done regarding the topic ICT4D in Tanzania, where it is possible to identify an extended literature covering a vast range of topics and fields and aiming to portray development trends. Just to give a short overview of the scope of research done in recent years, one will find work in the fields of Digital Divide (Samii, 2009);

Health Information Systems (Kimaro, 2006; Mukama, 2003); Banking and Economic Impact (Kinda & Loening, 2010); Poverty Reduction (Chilimo, 2008; Mpogole, Usanga, & Tedre, 2008; Souter et al., 2005); Market Access and Marketing (Barham & Chitemi, 2009; Bryceson, 2011; Mwakaje, 2010); Social Exclusion (Fisher, 2007); Telecentres (Lwoga, 2010) Education (Lwehabura, 2008; Tedre, Bangu, & Nyagava, 2009; Wamakote, Ang'ondi, & Onguko, 2010); Library Services (Muneja, Abungu, & Makori, 2012) all of which have given some important contributions to help explain the importance of ICTs in promoting social and economic development.

The above suggests looking also at the relationship between ICT and development discourse. For instance, in recent years there has been an increase in research activity on food security in developing countries (Thornton, 2010), making significant efforts in understanding how the use of ICTs (Ngowi, Mwakalobo, & Mwamfupe, 2015) can help to promote a shift towards the modernisation of agriculture, given the importance of that sector in the majority of the developing countries. This is perhaps why a significant body of literature has emphasized the use of ICTs to promote the modernisation of agriculture. For instance, it is suggested that the "growing ubiquity of mobile phones presents an excellent opportunity to put timely agricultural and livestock-keeping information into the hands of agro-pastoralists" (Ngowi et al., 2015, p. 89), which represents one of the key factors to promote development and help to consubstantiate important objectives of the Millennium Development Goals (MDG). Those cases underline the real spirit of the ICTs to leverage development, illustrating how perceived key challenges could be tackled through the use mobile phones for instance.

All cases illustrate the importance of access to information and how the possibility of communicating in an autonomous way can dramatically change the decision-making process. Levin & McEwan (2000, p. 156) suggests that "information holds the key to increased competitiveness, increased efficiency, improved resource allocation, and enhanced effectiveness'". In an operational perspective, the device has brought more options, helping to generalise some processes and helping therefore some communities in developing countries to shift their livelihood strategies. For instance, in the particular field of agriculture/livestock it has been claimed that the mobile phone could play a fundamental role in the implementation of key changes and help to promote a

more sustainable use of resources such land and sources of water. In two specific sub-sectors, the fishing sector (Nordström & Myhr, 2006; Nunan, 2010), and pastoralism (Kariuki & Kaitho, 2006, Ngowi et al., 2015), mobile phones have been studied in the Tanzanian context and research results suggest positive outcomes. Those results need to be borne in mind in order to understand how those positives outcomes can be escalated or benchmarked to other activities or cases. Nonetheless, there are some counter-examples such as the case of the tomato traders (Molony, 2008), where traders pointed out that the mobile phone was not helping them, or the work done by Wyche & Steinfield (2015) which pointed out that those people "perceived mobile phones to be devices that support verbal communication among their friends and family, rather than as platforms that deliver agricultural information in the form of a text message". Those actors preferred face-to-face interaction (Molony, 2006) and emphasized by Cetina (2009) as an *off-line mode* of communication, a relationship characterised by "a face-to-face or distant relationship based on a mutually beneficial association between three or more individuals" (Molony, 2006, p. 69), which means that this is part of a much deeper personal business relationship because they "allow for the sharing of information regarding prices, market conditions, and contacts, thereby leading to new business opportunities" (idem, p. 70).

Nevertheless, the mobile phone seems to have helped many users in LDCs, to implement key changes in their activities, and the outcome is positive. For instance, both face-to-face and distant relationships seem to have improved, and have nourished a high level of social capital amongst the trade community which has been discussed in relevant literature on ICTs and SMEs in East Africa (Mehta, Semali, & Maretzki, 2011; Molony, 2008, 2009; Morawczynski & Miscione, 2008; Narayan, 1997). All of these researchers suggest the importance of the mobile phone in strengthening market relations.

The above makes it important to make a small detour and add to what I pointed out in the introduction of this thesis. In 2.3.2.7. I noted that the word market would emerge frequently throughout this research but meaning two different things: one use would be in italics to make reference to the place where those pastoralists trade the cattle and the other using a normal font to refer to a market as a system supporting transactions. I will now convey the second formulation and briefly discuss this matter. Nevertheless,

it is important to note that this research is not about a sociology of markets, which is why I am not going too far into building an understanding of what market is.

- **Markets in the information economy**

That said, let me clarify what market stands for. Firstly, with regard to its original source, the terms seem having its genealogy in the Latin noun *marcatus*, and in concerns its meaning Ciborra (1983, p. 145) suggests that the market as an "alternative institutional arrangement" supporting transactions, or "places where purchasers live or with respect to number of demographic characteristics of purchasers" (Sissors, 1966, p. 17). This suggests that the definition of market is broader and most likely not extinguishing in the above definitions. Sissors (1966, p. 17) when referring to traditional ways of looking at markets suggested that those are often referred to a generic class of products such as beer market, vegetable market, car market etc. but this also fails short to provide a clear enough explanation. For instance, to try make it clear it is necessary to divide the market by generic class of product (agricultural market), subclass (livestock market), and within the subclass by name (cattle market or chicken market).

The above author suggests that the "more precisely that subclass product users are identified, the better is the possibility for understanding markets" (idem, ibidem), e.g. "from a managerial perspective, the comprehension of the different consumer profiles provides the information and knowledge to address the market segments efficiently regarding communication campaigns, packaging, merchandising, and branding" (Bezençon & Blili, 2011, p. 683), suggesting that a market can be created, suggesting new forms of market, e.g. the global market – in which the notion of free market constitutes the "blueprint" (Adam Smith, *cf* in Herzog, 2013, p. 30), suggesting that both nature and institution can potentially generate frictions with one free will and the responsibilities attached to institutions accountable to safeguard the natural equality, which makes clear that the "challenge is thus to keep up legal equality in the face of vast inequalities of property and to make sure that 'the power of purchasing' does not lead to 'political power, either civil or military' (idem). This suggests that markets not only need to be regulated but also need to be supported by an ethical perspective.

“Bound up with all of these is another overriding characterization of modern society as [being imminently a] market society or commercial society: that is to say, one which was increasingly dominated in all its aspects by monetarized exchanges of goods” (Slater & Tonkiss, 2013). In this commercial society data is of capital importance, suggesting the existence of an information economy or an information market, mainly when taking into consideration that “three of the world’s seven billion people are now computer-mediated in a wide range of their daily activities far beyond the traditional boundaries of the workplace” (Zuboff, 2015, p. 77). This has dictated a new logic, for instance the logic of accumulation in the network sphere and opened up a space for a new idea of market to emerge.

The above said brings an increased responsibility for institutions accountable for regulation and policy making, and opens up space for a few questions to be asked, for instance: “who learns from global data flows, what and how? Who decides and how? What happens when authority fails” (Zuboff, 2015, p. 77) to prevent access to data that can be sold to data brokers without consumers’ knowledge or consent? The logic in the era of the surveillance capitalism seems to suggest that “an auction happens every time a search takes place”, and this naturally influences our perception regarding the global market and the information society.

Those facts give body to important questions, which are relevant to this research. For instance, both the Maasai and the Wasukuma seem to have different understandings and consequently, they behave differently because they have different ways of experiencing the social reality and this will challenge their perception of the market. In this particular I suspect that their vison of the market will be similar to what Geertz claims to be the “peasant market [i.e.] the nearest real-world institution [which is] so embedded in its sociocultural context as to escape […] the reach of modern economic analysis altogether” (Geertz, 1978, p. 28). This makes the adoption, and consequently, the perception of the mobile phone and LINKS, different because the context and the sociotechnical arena are different across those two regions. They do not offer similar conditions to disclose existent affordances of the technology, and potentially they will determine different levels of appropriation, with different implications for production and marketing activities.

This suggests the need to be aware of transformations taking place in each of the regions. In this particular Avgerou (2010) has pointed out a prevalence of two dichotomized perspectives of the impacts of the ICT4D programmes: the "progressive transformation" (idem, p.6) which argues in favour of ICT "as an instrument for economic and social gain" (idem, ibidem) and the "disruptive transformations" (p.7), suggesting that those technologies will involve actions "with unequal effects on different categories of population" (idem, ibidem). This is what is expected from an ICT4D initiative. However, the critique suggesting the opposite is acute, suggesting that it is necessary to move beyond the deterministic agenda, which takes for granted that development would emerge automatically from adoption of ICTs without a considerate understand of the context of use. This has blurred many promising trajectories, which would eventually help host countries (LDC) to steer their way through the information super highway, as the former president of the USA, Bill Clinton, and his vice president, Al Gore, suggested it would.

Evidence suggests that there is a root cause inherent to frequent ICT4D projects failure (Braa & Hedberg, 2000; Heeks, 2002; Kitiyadisai, 2000; Moussa & Schware, 1992). Looking at the Tanzanian reality I would place those causes at two dimensions, one more structural (lack of adequate sociotechnical infrastructures) and the other more circumstantial (the idiosyncrasies of the tribes inhabiting each of the regions), which will potentially undermine i) generalisability, ii) scalability and iii) sustainability, determining that those projects (ICT4D) frequently will have limited impact. Breaking-down those three aspects, I would say that **i)** the barriers to generalisability are grounded in the lack of technical infrastructures, which would allow the enlargement of those projects, even if they were successful during the pilot phase. This prevents them from being implemented in a more formal setting and on a large-scale (i.e. countrywide), with the rural areas being the most penalized. For instance, Wellenius (2002, p. 3) when analysing the telecommunication sector development between 1988-2000 concluded that "about 15 percent of all Chileans lived in localities that did not have a payphone". This is a trend, and it can be symptomatic in other undeveloped countries, being the Sub-Sahara countries being the most deprived in this urban-rural gap. Concerning **ii)**, the evidence suggests (Foster & Heeks, 2013b) that difficulties in making those projects scalable are determined by the lack of resources,

namely financial, to help some very innovative and promising solutions spin off from the incubator and move to the growth or maturation stage. As such, those two will determine a key factor' i.e. **(iii)** the sustainability of any project, which normally is short. Those projects frequently will lose their momentum after the donor or aid agency withdraws their support (financial, material and/or human) and this is done before the real seed has germinated. Those projects normally will end up locked in a drawer in the form of a very optimistic report, which has previously allowed some political fanfare, but as regards the benefits for the user, normally they are far away from bringing the promised change. This has divided the scientific community, politicians, practitioners and users into two opposite communities, the first two being defenders of the idea of ICT4D, and the latter two very critical and sceptical, since very frequently the project will not work, or will never be known by the one that should benefit from it. Nevertheless, as I have said previously, the mobile phone is a particular case amongst the range of ICTs used in those programmes. With regards to this, and even if specific literature in this topic can point out many cases of ICT4D failures, with the mobile phones positive accounts are frequently to be found. In this particular case, there is a relevant body of literature pointing to a significant number of cases of success, and this suggests the question, why is the mobile phone capable of delivering what any other ICT was unable to deliver so far? This is a question that this thesis seeks to contribute to answering.

4.5.1. New perspectives to understand ICT4D failures

The idea of ICT4D has been subject to critical appraisal by a number of scholars on both conceptual and practical grounds. The concept of ICT4D emerged from the expectation that ICT could help address many of the struggles with which many of those living in the South are engaged. Aid agencies, international organisations and governments have during the last decades searched for new routes and best options to implement development programmes in order to tackle poverty. ICT was often conceived as a technical fix to these problems. However, there has been a recurrent pattern of failure. In this perspective, Heeks suggests (2002) putting emphasis on the evaluation process as a way to mitigate the numerous cases of ICT4D failure, even

though many cases of failure today can be cases of success tomorrow and "vice versa" (Heeks, 2002, p. 101) However, as Heeks observes: "[r]igorous impact assessment is the Macavity of ICT4D – much talked about but hardly ever seen" (Heeks, 2002, p. 27), pointing out that "processes of technological change – innovation, transfer, adaptation, implementation – are central to development. Yet they are typically black-boxed in research accounts so actors and practice remain hidden", (Heeks & Stanforth, 2015, p. 33) or in large part lost in the political-administrative and economic interstices. Consequently, it is necessary to shift to a focus to the translation process, and place attention on the users and on the social leaning process, namely in how those actors explore the technology, disclosing affordance which enable them to intervene in the context. With regards to the term translation, and taking it from the perspective of ANT, even though I not using this approach to conduct this research. Law (2009, p. 141) is describing ANT as "a disparate family of material-semiotics tools, sensibilities, and methods of analysis that treat everything in the social and natural worlds as a continuously generated effected of the webs of relations within which they are located" which implies the construction of facts, translating languages, concepts, ideas and materials from one space to another, therefore enrolling "others so that they participate in the construction of the fact [and] control their behaviour in order to make their actions predictable" (Latour, 1987, p. 108). This calls for translation, which is the "interpretation given by the fact-builders of their interests and that of the people they enrol" (idem. ibidem).

This inspired me to focus attention on reasons underlining failure, not because I consciously want to draw a pessimistic account, but because rigour so determines, since failure is frequent and emerges as linked to lack of assessment of the impacts when translating western technologies into developing countries, mainly because those "processes in practice are found to be complex, messy and dynamic" (Heeks & Stanforth, 2015, p. 35). Therefore, "[e]valuating impact is particularly critical in developing countries where resources are scarce and every dollar spent should aim to maximize its impact on poverty reduction" (Baker, 2000, p. vi). This uncovers some of the reasons determining failure, which can be categorised differently. For instance, Heeks (2002) suggests that failure can be classified in three ways, **total, partial**, and failure of **sustainability**. Breaking this down, and in what concerns the total failure, it

is not necessary to put much effort into identifying the cause for such outcome: normally the project never took off or it was abandoned just after being set up, and in these cases I would point out technical issues as the frequent root of the failure. At the other end, there is the sustainability failure, and I would point to reasons such as the lack of resources (financial and technical) to which I should add the lack of political will, or disagreements between donors and official authorities about keeping the project running throughout different stages of maturation, such as "incremental rollout, aggressive growth, and standardisation" (Foster & Heeks, 2013). The second reason, partial failure, is suggested by Heeks as being "more difficult to identify because identification grapples with the issue of subjectivity" (Heeks, 2002, p. 102).

However, notwithstanding a significant number of failures, some ICT4D programmes have enabled some important changes at organisational and societal levels in the development context. This may be why the debate has not achieved a consensus, suggesting the need for new methodologies and concepts to evaluate those processes. Again, as I have pointed out earlier, the "*design-actuality gap*" proposed by Heeks (2002, p. 104) is a promising tool, whose aim is to help anticipate trajectories and increase chances to match the design process to local use. The tool will give an opportunity to evaluate the present and the future of a given system, i.e. "where we are now […and] where the design want to take us" (Heeks, 2002, p. 104) and by using this approach I believe that the ICT4D community will see the mechanisms of assessment enhanced and averting the tendency of taking for granted that those technical fixes will automatically work when implemented in LDCs. This will also give the chance to shift the discourse of development from a rhetoric of "discontinuity [to a logic of] evolution" (Heeks, 2009, p. 28) by acknowledging the active and interventionist role of users.

This turn towards evolutionary understanding heralds a significant shift in understanding of ICT4D – and an area in which I hope this thesis will contribute to debate. Rather than focus exclusively upon design of ICT4D solutions (which still tends to look to ICT4D as a 'technical fix', I draw upon recent Mark II STS work (Russell and Williams 2002, Stewart and Williams 2005) to draw attention to how these solutions may be reconfigured by users in the context of use. Reassembling those

generic “off-the-shelf solutions” (Heeks, 2009, p. 4) to the particular needs of the users in their contexts they will better appropriate those options, and also, contribute to a decrease in failure. I draw attention here to the ICT4D 2.0 Manifesto (Heeks, 2009), which reflects upon conceptual developments, posing the question “Where Next for ICTs and International Development?”, and points to a new agenda for ICT4D, both in what concerns research and implementation. The manifesto provides a chronology of the development of the ICT4D concept and offers a new perspective, which places the user and the context of action at the core. It charts the evolution of the ICT4D concept that is placed in 3 phases (ICT4D 0.0, 1.0 and 2.0) which are the outcome of tensions between, practioners, politicians and academics, being the most visible, and classic, the tension between the modernisation and the dependency theorists.

With regards to those 3 phases it is suggested that the first stage (ICT4D 0.0) will correspond to the period from the late 1950s until 1990s, and it is characterised by attempts to implement IT solutions to address needs regarding “internal administrative functions of the public sector in developing countries” (Heeks, 2009, p.2), Later, during the 1980s, the IT sector evolved with the advent of the microcomputer, and brought a new hype (PC+database), and those resources would be the mechanisms of governance or mechanisms to deliver growth, and they become known as IT4G. Yet, and because the strategy was grounded on the modernisation rationale, consisting in transfer modern technology into LDCs in order to close the gap, most of those initiatives failed to deliver development due to translation issues (please see section 4.4.).

During the 1990s, both the Internet and the MDGs boosted the development agenda, and the strategy shifted from IT4G to ICT4D, to be used to “reduce poverty, and improve health and education and gender equality” (Heeks, 2009, p. 3). The internet become then the central technology of the 1.0 phase and converted in the mechanism to deliver the Millennium Development Goals. Nevertheless, the strategy to give access to digital content through telecentres failed to accomplish that mission, and reasons can be suggested as a lack of assessment of the sociotechnical capacity of the country/region adopting the resource.

At the beginning of the 21st century the mobile phone emerges as a key technology helping to reformulate the development and research agenda. Heeks points out that this has been the 2.0 phase, emphasizing the "user-up approach of understanding how existing technologies were being applied within poor communities" (Heeks, 2009, p.5). This seems to me aligned to the SST MK2 strategy, mainly when placing emphasis on the users, this being the reason for my decision to ground my analysis on those two perspectives of analyses of the relationship technology/society, namely when applied in LDCs, and this is expected to help me to consolidate the research analytical framework.

***Issue* / Phase**	**ICT4D 0.0** (1960s – mid-1990s)	**ICT4D 1.0** (mid-1990s – mid-/late-2000s)	**ICT4D 2.0** (mid-/late-2000s onwards)
Iconic Technology	PC Database	Telecentre	Mobile Phone
Key Application	Data Processing	Content (& Interaction)	Services & Production
The Poor	Who?	Consumers	Innovators & Producers
Key Goal	Organisational Efficiency	MDGs	?Growth & Development?
Key Issue	Technology's Potential	Readiness & Availability	Uptake & Impact
Key Actor	Government	Donors & NGOs	All Sectors
Attitude	Ignore --> Isolate	Idolise --> Integrate	Integrate --> Innovate
Innovation Model	Northern	Pro-Poor --> Para-Poor	Para-Poor --> Per-Poor
Dominant Discipline	Information Systems	Informatics / Development Studies	Tribrid of CS, IS and DS
Development Paradigm	Modernisation	Human Development	?Development 2.0?

Table 8: Summary of ICT4D Phases, source Heeks, 2009, p. 28

The topic (ICT4D) has been the object of extensive research in recent decades and has produced many perspectives, tools and concepts to try to find the best way to take the benefits of such technologies and to illustrate the relationships and existing links between ICT and development in the sub-Saharan context (Avgerou, 1998, 2003; Avgerou & Madon, 2005; Avgerou & Walsham, 2001; Donner, 2008a, 2008b; Ngwenyama, Andoh-Baidoo, Bollou, & Morawczynski, 2006; Sein & Harindranath, 2004; Slater & Tacchi, 2004; Thompson & Walsham, 2010; Toivanen, 2011).

A substantial part of that work concluded that developments emerging from the implementation of ICT4D projects are not straightforward, and this has paved the way for more acute critiques, based on a significant number of unsuccessful cases of technology and policy transfer. In this respect Avgerou (2003, p. 3) suggested that the link between ICT and economic development is dubious, yet it is suggested that ICTs can help to improve economic development of those depending on agriculture (Wyche & Steinfield, 2015, p. 1). This is especially so with the dissemination of market information (prices), which helps develop "network ties" (Nyarko, Hildebrandt, Romagnoli, & Soldani, 2013, p. 14) and playing a key role in rural development and livelihoods (Chapman & Slaymaker, 2009), emphasizing economic and new markets trends (Aker, 2008; Aker & Mbiti, 2010) specifically when enabling:

> *"access to and use of information, thereby reducing search costs, improving coordination among agents, and increasing market efficiency. Second, this increased communication should improve firms' productive efficiency by allowing them to better manage their supply chains. Third, mobile phones create new jobs to address demand for mobile-related services, thereby providing income-generating opportunities in rural and urban areas. Fourth, mobile phones can facilitate communication among social networks in response to shocks, thereby reducing households' exposure to risk. Finally, mobile phone-based applications and development projects— sometimes known as "m-development"—has the potential to facilitate the delivery of financial, agricultural, health, and educational services."(Aker & Mbiti, 2010, p. 214).*

This makes it possible to conclude that mobile phones have affected the discourse of development. In addition, there is some early literature within the Tanzanian context (Ellis & Mdoe, 2003) that has highlighted ICT as an interesting area for media research, pinpointing some important shifts. For instance:

> *"The rate at which Tanzanians are embracing mobile communications technology indicates that there is significant potential for future growth [and with] proper education mobile phone use will be based on development, business, mobile phones economy, and productivity." (Pettersson, 2008).*

In the particular field of pastoralism, recent studies (Debsu, Little, Tiki, Guagliardo, & Kitron, 2016; Ngowi, Mwakalobo, & Mwamfupe, 2015; Waters-Bayer & Bayer, 2016) show an increasing use of mobile phones among the pastoralists, and how artefact is now becoming critical to their lives. For instance, the study conducted by Ngowi, Mwakalobo, & Mwamfupe (2015, p. 86), underline "the extent of the interaction between the telecentre services and agro-pastoralists in terms of ICTs

access as a learning, [pointing out] that more than half, 43.7% (178) and 23.6% (96) out of 407 respondents were interacting; whereby agro-pastoralists access the services provided by the telecentres to improve agro-pastoral livelihood."

According to the ITWorld[36] "the cell phone has revolutionized the way pastoral communities operate"[37]. For instance, in the south of Kenya and the north of Tanzania, the Maasai until very recently were perceived to be resistant to adopting modern technologies. The "prevalent perceptions about pastoralists were that they are a minority of people who practice an archaic and outmoded operate[38] ". This comes from generic observations of how long it has taken some of them to adopt some technologies and artefacts such as those related to health care, construction of houses, domestic appliances like irons, etc., which are considered basic and obvious essentials to other communities. However, with the mobile phones, the adoption process was fast. The way in which this technology is aligned to the mobile nature of pastoralism may be the main reason for this significant and peculiar adoption.

> *"[Presently, by using] the cell phone, communities can make calls to warn adjacent villagers of cattle thieves and rustlers, which has made it hard for the attackers […]. Mobile phones have also changed the way these communities conduct business: For example, herders call Nairobi to find out the market rates for their livestock, and they can receive daily prices via SMS (Short Message Service), enabling them to demand better rates from livestock buyers"*[39].

The cases of Kenya and Tanzania are two examples of high use of mobile phones and used by livestock producers to support livestock trading. Besides that, mobile phones are present in many other areas of economic activity, one reason being that it is one of the most popular ways of making payments in East Africa. For instance the M-pesa application (Foster & Heeks, 2013a; Mas & Morawczynski, 2009; Morawczynski, 2009, 2010; Morawczynski & Miscione, 2008), known as the 'mobile wallet' (Rutten & Mwangi, 2012), and the MFarm (Solon, 2013) both require the use of mobile

[36] The ITworld is a Reuters subsidiary company whose major activity is related with news regarding the use of Informational Technologies

[37] https://www.itworld.com/article/2779014/mobile/cell-phones-help-pastoralists-fight-livestock-theft.html, accessed on 13/06/2018

[38] https://www.itworld.com/article/2779014/mobile/cell-phones-help-pastoralists-fight-livestock-theft.html, accessed on 13/06/2018

[39] idem

phones. Consequently, I would claim that different reasons and factors can underlie technological prediction of a doubtful result; mainly because the implementation process will not always follow a straightforward trajectory; there are sets of actors and structures that evolve in many different forms and directions in the changing world, and this can make the transfers of technology or knowledge an extremely complex process (Morales-Gómez & Melesse, 1998, p. 7). Those are the reasons why I believe further concepts and tools are needed to better understand the role of ICTs when used to promote development.

There is still some work to be done on the best strategy to guide policymaking actors and aid agencies implementing this important shift, nevertheless safeguarding what is suggested by Avgerou & Walsham (2001, p. 44) as being: "an a-contextual attitude to ICT exploitation in spreading powerful messages about the significance of ICT in the contemporary economy. But it entails high risks of misguiding and frustrating local efforts to make sense and appropriate new technology", reasons why I suggest that it is important to "involve target groups in project design and monitoring" (Dutta, Lanvin, & Paua, 2003, p. 9) of any ICT4D project. Moreover, we should try not to see those projects as independent factor and the ICT "as an end in itself" (idem, p. 14) since:

> *"their potential value, their fit in the local socio-organizational conditions and feasibility of use cannot be taken for granted. Indeed, there is a substantial evidence indicating the significance of addressing the local context [and users) for the exploitation of new information and communication technologies in developing countries" (Avgerou & Walsham, 2001, p. 44).*

During the fieldwork, I had the opportunity to collect data and to make observations that confirm and update the above information. In my empirical section, I will illustrate some of the strategies that were put in place to try to close the urban-rural gap. Next, I present two figures, which aim is to encapsulate the Tanzania landscape in respect of the mobile penetration rate and the characteristics of the mobile market in Tanzania. Concerning the infrastructure:

"Currently the country has over 3000 kilometres of fibre optic cable installed which is currently being utilised in building up the national ICT backbone infrastructure. The Government has embarked on a more ambitious programme of which includes a project to build over 10,000 kilometres of fibre backbone, which will form the National ICT backbone. […] This geographical spread of the fibre has the potential of reducing the digital divide between urban centres and rural areas and spearheading development of broadband services in the country. Currently the fibre covers over 15 regions and over 40 districts of Tanzania[40]".

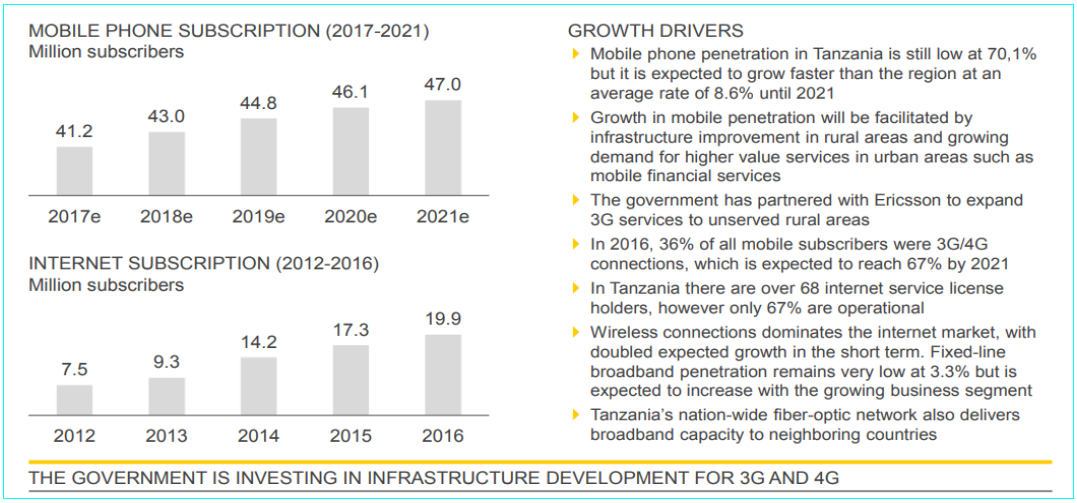


Figure 18: Mobile phone and Internet subscription 2017-2021 – Source: BMI Tanzania telecommunications Report 2017, Tanzania Communications Regulatory Authority

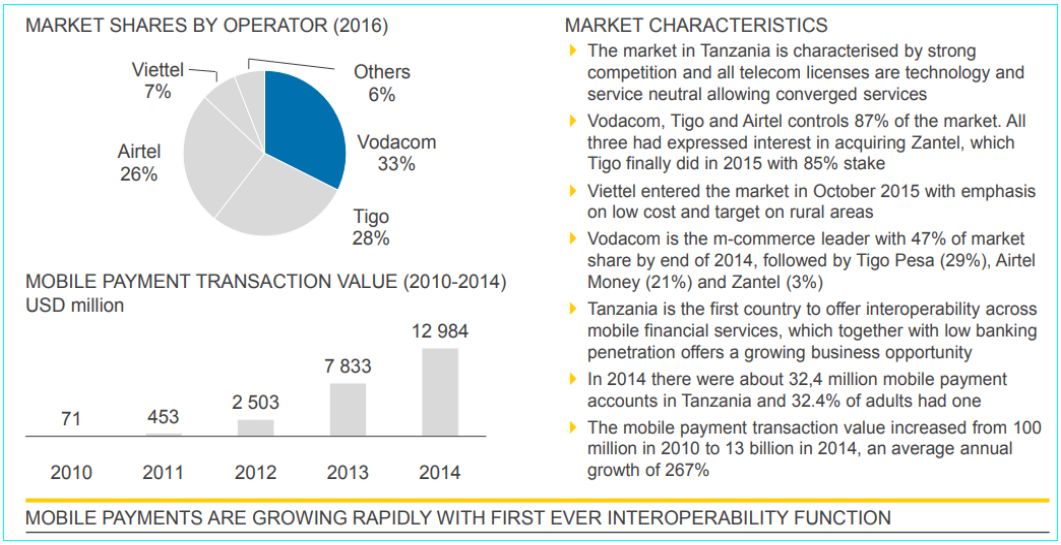


Figure 19: Tanzania telecommunications report q4 2015, Tanzania Communications regulatory authority, BMI Sub-Saharan Africa mobile financial services outlook: 2015-2019

Analysing the mobile phones use in Tanzania from an individual level, gives a chance to interpret how those users are disclosing the affordances enclosed in the object, and therefore unlocking the potential of that technology, which due to its level of

[40] http://www.tzdpg.or.tz/fileadmin/_migrated/content_uploads/ICT_Final_Report-30June10.pdf

adaptability does not emerge as finished product of technological innovation. The device arises as continuously open and subject of the user activity when struggling to make it work in the context where they are immersed. This gives the users different scope for appropriation. This aspect will be discussed in more detail in the empirical section in the concluding chapter of this thesis.

4.5.2. Generic Solutions Vis-à-vis Generic Functionalities

It is not always possible to make ICTs work in the same way in different contexts, especially when those resources are imported from a different region in the world (global) and brought into particular regions (local) and used as a technical fix ((Pacey, 1983, p. 10; Williams, 1997, p. 7) to solve specific problems. Here it is important to develop further my criticism, mainly when the attempt to address the issue is supported in the idea that the technology can be bought directly "off the shelf" and solve a given set of problems as a "magic bullet". This is not possible, since what is perceived as the "*technical fix*" is not loaded with enough "plasticity" (Williams, 1997, p. 12) to allow the reconfiguration (shaping) by local and social requirements, or as Pacey has pointed out "to hope for a technical fix for any of them that does not also involve social and cultural measures is to pursue an illusion" (Pacey, 1983, p. 10), which is not possible to be achieved with recourse to generic solutions (finished/closed), once they do not offer the user the same scope for intervention and for reconfiguring the technology during its implementation and use. Concerning this issue, I can make use of the classic example of the initiative One Laptop per Child (OLPC), which failed to deliver the promise, because the technology used (generic solution), did not offer space for intervention and adaptability to the context. It is said that "OLPC has been forced to dramatically scale back its ambitions" (Kraemer, Dedrick, & Sharma, 2009, p. 66) mainly because it is necessary to take into consideration that for those generic solutions to work it needs things as simple as "design and installation of supporting IT and power infrastructure." (Idem p. 73). It is in this aspect that the mobile phone makes a difference, because at the immediate point of use very little support is needed. One individual alone will be able to make its generic functionality work, i.e. to dial a number and press green to talk to someone, which correspond to the most important affordance of the thing.

When looking at those phenomena in a more particular way I found a subjacent logic; for instance, in what concerns consumption it seems to support the idea that the more generic functionalities the technology has, the wider the chance for its applicability and use, and therefore to be appropriated. In contrast, the more specific (complex) the technology is, the narrower its applicability and use will be, therefore the opportunities for the integral use of those technologies will be restricted to a narrow dimension, which makes it hard for users to explore hypothetical affordances.

The first perspective introduced above is a good way of explaining the expressive adoption of mobile phones worldwide. The device emerges frequently as "open" in what concerns its generic functionalities, which enlarges the scope for its configurability. Looking at the integration of ICTs for education in LDCs it is possible to conclude that:

> *"[u]nlike the problems of using computers, wherein there is a substantial learning curve for administrators, teachers and students, and issues as to expense, maintenance and obsolescence, texting is already being done by a significant chunk of the population who have already been empowered to make use of mobile phone technologies, which points to its superior user-friendliness". (Ramos, Trinona, & Lambert, 2006, p. 8), [or looking at the] "role of mobiles in disaster relief and prevention [it is possible to conclude that] most of the poor surveyed in Asia cite the mobile's role in an emergency as its most useful instrumental function" (Rashid & Elder, 2009, p. 13).*

Nevertheless, and before I move forward I would like to emphasize that it is important to bear in mind that the users' requirements, and other social aspects of the context where technology will be integrated. Those are important factors in any process of technological change, as they will broaden the scope regarding the way technology is perceived, appropriated and integrated into daily routines, enabling those to develop or enhance their resilient character and give ground for different forms of assessment regarding the relationship technology-society to be done.

4.5.3. Relation between ICTs and the capacity to build resilience

Poverty, disease and chronic food insecurity are classical problems affecting the global South. Environmental disasters and climate change events are making an increasing impact, in terms of intensity and frequency. These events, in connection with others, such as the inequalities of access between the first, second and third worlds to participation in the global network society, are increasing the level of vulnerability of

a substantial part of the world's population, a large number of whom live in developing countries, and among them the poorest of the poor and the weakest of the weak: women and children.

The above said calls for mechanisms to prevent, or to help, those actors to recover from the impact of those shocks. In the context of this research a relevant question emerges, which is to identify if there is any relation between ICTs and the capacity to enact resilience, a strategy that can be useful for tackling the above problems. There is some literature on this topic (Béné, Wood, Newsham, & Davies, 2012) that can provide us with some elements of the answer to that question as I shall explore in the paragraphs below.

Recent research has produced important literature on the topic, which stresses resilience as a new field. It cuts across different fields of intervention (Bahadur, Ibrahim, & Tanner, 2010; Manyena, 2006) involving different sectors of activity, among them policy makers, practitioners and researchers. It is claimed that resilience as a concept is gaining critical mass in academia and becoming "a central paradigm […] possibly replacing sustainability as the ultimate objective of development" (Béné et al., 2012, p. 8) and more recently there are some, albeit tenuous, attempts to link it to Innovation Studies (Westley, 2013).

Béné et al., when reflecting about the potentials and limits of the concept of resilience in relation to vulnerability reduction programmes, tracked the origin and definition of the concept and suggested that from the perspective of innovation, resilience is perceived as a multidisciplinary process. Resilience was originally a technical concept that emerged in the field of engineering, and as a form to classify structures/systems. It has been defined more recently as the "degree of preparedness and capacity to recover […] or the ability of a system and its component parts to anticipate, accommodate, or recover from the effects of a hazardous event in a timely and efficient manner" (Idem, p. 11), and therefore a useful concept to help us to understand strategies to be used to fight poverty and underdevelopment.

Pastoralism is a good example of an area where the concept could be explored further. Pastoralism and pastoralists are resilient in themselves, (John G McPeak & Little, 2017), and both are facing permanent environmental changes which impose new

challenges., Some of these challenges are associated with classic vulnerability factors such as the risks of drought/dry season, disease, and conflict over the land possession, all of which has increased in recent times, "although vulnerability to shocks has decreased over the years" (Majekodunmi et al., 2014, p. 1). This has augmented the tension, and new phenomena and symptoms have arisen as a consequence of those tensions, the most obvious being the apparent shrinking of the territory, specifically areas for grazing.

Grasslands are now disputed by a huge range of competitors, from wild life (zebras and wildebeest) to humans with their activities, such as hunting safaris in game-controlled areas. Pastoralists' livelihoods depend on natural and socio-political factors, among them "access to assets such as land, livestock, pasture, water, animal health services, community networks, markets, credit and education; second, the environment in which these assets are combined for production and consumption, specifically the political, organisational and institutional infrastructure within which they operate" (Majekodunmi et al., 2014, p.1).

Recent strategies have placed emphasis on shifting the panorama from a situation of vulnerability to a capacity to build a resilient system, that is, finding and implementing strategies to promote "diversity, flexibility, inclusion and participation; which recognise social values, accept uncertainty and change (on a multi-scale); and which foster learning." (Béné et al., 2012, p. 19) which will empower those communities.

However, the use of this concept poses some philosophical questions, the most prominent relating to the meaning of the word resilience; is it a paradigm or an expression? There have been some attempts to answer this question, but it still is not possible to achieve one good answer and a consensus, with different views and interpretations interplaying within different contexts of use. Nevertheless, etymologically speaking, resilience is:

> *"(i) the act of rebounding or springing back and (ii) elasticity. The origin of the word is in Latin, where resilio means to jump back. In a purely mechanical sense, the resilience of a material is the quality of being able to store strain energy and deflect elastically under a load without breaking or being de-formed. […] Since the 1970s the concept has also been used in a more metaphorical sense to describe systems that undergo stress and have the ability to recover and return to their original state." (Gordon, 1978 cf in Klein, Nicholls, & Thomalla, 2003).*

Klein et al. (2003) claim that the “concept of resilience has gained currency in the absence of philosophical dimensions and clarity of understanding, [perceived as fundamental characteristics of a ground theory. However, in] definition, substance, and most importantly, its applicability in disaster management and sustainable development theory and practice [it is paramount.]” When referring to people, the concept is used in connection with physical and psychological characteristics such as the capacity to quickly recover from “shock, illness or hardship. One who is resilient may be considered irrepressible, buoyant, enduring, flexible; the person who bounces back—unchanged—from exposure to stresses and shocks” (Vickers and Kouzmin, 2001).

It is claimed (Béné et al., 2012; Klein et al., 2003; Manyena, 2006) that the capacity to adapt plays a key role when people have to deal with the issues of hazards and hardships, and resilience becomes something of “a contextual and personal construct because it depends on the high-risk status or degree of exposure of the people in danger and their personalised adaptive strategies” (Manyena, 2006). As such, it seems important to define strategies to empower people in those circumstances in order to “directly addresses people's lack of control over their destiny” (Cadell, Karabanow, & Sanchez, 2009, p. 10).” For instance, Paton & Johnston, (2017) when talking about social resilience emphasized the need to empower local communities, nevertheless, acknowledging “that empowerment is not an easy process, particular when the most vulnerable, the least resilient, are often those least able to cope generally and who may also be isolated from mainstream resources” (p.97) preventing them “from exercising or experiencing self-determination, distributive justice, and collaborative and democratic participation” (Prilleltensky, 1994, p. 359) and foster them as a mechanism to psychologically cope (self-righting) “at a level far greater than expected given the individual's capabilities and previous experiences” (Paton & Johnston, 2017, p. 173).

Therefore, I see the capacity to adapt through resilience as the capacity to disclose affordances existing in the context. It is in this aspect that ICTs are claimed to be the tool to leverage development, namely when allowing people to gain "belief they can control their worlds" (Wallerstein, 1992, p. 202). In this research case, the mobile phone and the sociotechnical infrastructure that support its use seems playing a relevant role, mainly when opening up new possibilities of action for both the Maasai and the Wasukuma. This is important to bear in mind because it appears to be a direct relation between the appropriation of mobile phones – when disclosing what it can afford – and the possibility to enact resilience.

Figure 20 – Depicting the Resilience process: third element of my analytical framework

As such, I can resume resilience as a mechanism resulting from bi-dimensional process: endogenous and exogenous. Endogenously, it can be perceived as a psychologic process, which is supported on possibilities of action supported by disclosing the affordances existing in the technology/context. This is made possible through innovative and creative processes of integration of the things existing in the material world (appropriation). Exogenously, it can be perceived as the result of the appropriation-affordance overlapping process, which, as I have explained earlier, is a retroactive and incremental process. This process enables individuals to interact differently in the world where they are immersed, perceiving it as more fluid and possible of being intervened upon. Concluding this section, I will present in the next page a frame with a revision of the resilience definition as suggested by Manyena (2006).

Author	Definition
Wildavsky, 1991	Resilience is the capacity to cope with unanticipated dangers after they have become manifest, learning to bounce back.
Holling et al., 1995	It is the buffer capacity or the ability of a system to absorb perturbation, or the magnitude of disturbance that can be absorbed before a system changes its structure by changing the variables.
Horne and Orr, 1998	Resilience is a fundamental quality of individuals, groups and organisations, and systems as a whole to respond productively to significant change that disrupts the expected pattern of events without engaging in an extended period of regressive behaviour.
Mallak, 1998	Resilience is the ability of an individual or organisation to expeditiously design and implement positive adaptive behaviours matched to the immediate situation, while enduring minimal stress.
Miletti, 1999	Local resiliency with regard to disasters means that a locale is able to withstand an extreme natural event without suffering devastating losses, damage, diminished productivity, or quality of life without a large amount of assistance from outside the community.
Comfort, 1999	The capacity to adapt existing resources and skills to new systems and operating conditions.
Paton, Smith and Violanti, 2000)	Resilience describes an active process of self-righting, learned resourcefulness and growth—the ability to function psychologically at a level far greater than expected given the individual's capabilities and previous experiences.
Kendra and Wachtendorf, 2003	The ability to respond to singular or unique events.
Cardona, 2003	The capacity of the damaged ecosystem or community to absorb negative impacts and recover from these.
Pelling, 2003	The ability of an actor to cope with or adapt to hazard stress.
Resilience Alliance, 2005	Ecosystem resilience is the capacity of an ecosystem to tolerate disturbance without collapsing into a qualitatively different state that is controlled by a different set of processes. A resilient ecosystem can withstand shocks and rebuild itself when necessary. Resilience in social systems has the added capacity of humans to anticipate and plan for the future.
UNISDR, 2005	The capacity of a system, community or society potentially exposed to hazards to adapt, by resisting or changing in order to reach and maintain an acceptable level of functioning and structure. This is determined by the degree to which the social system is capable of organising itself to increase this capacity for learning from past disasters for better future protection and to improve risk reduction measures.

Figure 21 – Definition of resilience source: Manyena, 2006

4.5.3.1. The analytical framework

It is in this perspective that I find it useful to combine the *appropriation*, *affordance* and *resilience*, side by side with some conceptualisations around ICT4D 2.0, to form the analytical framework. I believe those concepts will give scope to deal in a more integrative way with issues of subjectivity inherent in a vast and complex network of players and circumstances involved in the sociotechnical change, such as the ICT4D project that I will analyse (LINKS). This case seems to be affected by a partial failure syndrome, i.e. there are different interpretations regarding the vision and direction of the change, which has opened up a dynamic between the top-down and bottom-up perspectives. This suggests a return to an important aspect which I have been highlighting, namely, why some western technologies fail to deliver their promise, since I believe that there is also a high degree of subjectivity regarding the conceptualisation of success and failure: the world view of the donor/aid agency, the local government and the beneficiaries of the project emerge frequently as unsynchronised, and that drives those initiatives into a significant degree of uncertainty regarding their outcome, or as Pacey has put it:

> *"Even on a practical level, some projects fail to get more than half way to solving the problems they address, and end up as unsatisfactory technical fixes, because important organizational factors have been ignored.[…]This made it clear that a machine deigned in response to the values of one culture needed a good deal of effort to make it suit the purposes of another."(Pacey, 1983, p. 8).*

Therefore, some actors frequently claim to have accomplished their mission (donor), others to having implemented the change (local government) and some (users) complaining about being unable to take the benefits from a given project. This is what I criticize, illustrating:

> *"Whose goals are unattained?" and "For whom are the outcomes undesirable?" Answers will only appear where evaluation methods recognize failure's subjectivity and recognize and interact with multiple stakeholder groups. Such recognition is, unfortunately, rare in evaluations of developing country (and other) IS projects (Heeks, 2002, p. 102).*

The above depicts well one important aspect that this thesis seeks to shed light upon, when trying to track reasons underlining the attempt to promote changes in the livestock market in Tanzania, and why it has not brought the expected result. With regards to this I also suggest that it is necessary to develop new strategies to assess

those kind of projects, and to make use of some of the existing tools which can be used in assessing the trajectory of ICT4D projects. This can be one way to understand the possible mismatch of visions between designers and users, and therefore to try anticipating failure which in:

> *"[…] most extreme form occurs when industrialized-country designers create an information system within and for an industrialized-country context, and that IS is subsequently transferred to a developing country. In such situations, the actuality of local conditions in the developing country will not have been considered at all in the original design, and a considerable design–actuality gap is therefore likely, leading to a significant risk of IS failure. (Idem, p.106).*

Furthermore, and as we have said earlier, there are prevalent issues in the translation of foreign S&T outputs which in large part are lost in the political-administrative and economic interstices, packed with imported scientific ideologies, which eventually represents a new form of colonisation. To this, I should add the absence of adequate sociotechnical infrastructures to support sophisticated forms of technology. This is claimed to create a certain degree of dependence (Agnew, 1982, p. 23; Hettne, 1983, p. 253) on foreign aid, with S&T policy perceived as another "mechanism of domination" (Shrum & Shenhav, cf in Jasanoff, Markle, Petersen, & Pinch, 1995, p. 630). This is relevant to help in understanding the role and scope of S&T in developing countries, and how the process of technology transfer takes place, i.e. supported on "short-terms strategies of private companies [which] do not necessarily or even ordinarily promote 'development'" (Idem, 636).

4.6. Operationalising the analytical framework: the appropriation ripples

"Time is fundamental to the orchestration and synchronisation of the social life [and it becomes even more important if [we] discuss the various dimensions of working time, and the interrelationships between working time, family and well-being" (Tammelin, 2018, p. 1). Therefore, time emerges as a critical component and a competitive factor in modern life, and is often perceived as having much more value than just the sum of minutes and hours (Daly, 2001). In this context, the capability of one being mobile is of major importance. One of the most adopted technology around the world to manage those issues is the mobile phone (Katz, 2008) once it increases changes for micro-

coordination of both the working time and the family time. Concerning this Ling & Lang point out to the possibility to:

> *"redirect trips that have already started; for example, one partner calling the other and asking them to stop in at the store on the way home. This might extend all the way into the store – the husband calls the wife while standing inside the store because he needs to know if it was whole or skim milk that was on the shopping list (which he left on the kitchen table). Another version is the "softening" of time; for example, sitting in a traffic jam and calling ahead to the meeting to let them know that you will be late."(Ling & Yttri in Katz, 2008, p. 143)*

The need to coordinate working time, family and well-being is no different for these two communities being studied, adding that for them, time emerges deeply intertwined with space, due to the long-distance journeys that they have to undertake. This equal, in practical terms, long hours of solitude and abstention from the family. In this context, the mobile phone emerges as very important technology to help those pastoralists to reconstruct their perception regarding time and space. Ling & Lia (2016, p. 1) suggest that "the most fundamental function of the mobile phone is to make us individually available to one another" and that is what those pastoralists needs considering the mobile character of their activity. In this particular "the mobile phones have the potential to dramatically change the mobility landscape [supporting] beneficial new livelihoods and life chances [and in parallel enabling] less visible performances of subterfuge and illicit activity (Porter et al., 2012, p. 146). Those are some of the reasons why ICTs can be seen as an enabling technology in the broader context of Agriculture (Aubert, Schroeder, & Grimaudo, 2012, p. 511). Furthermore, "the 'any time, any place, anywhere' mantra reinforces the 'flexibility' provided. If technology offers such limitless flexibility and facilitates 'wider engagement' through the reach it affords, then it has to be seen as an enabler" (Shiel & Jones, 2005, p. 3).

Consequently, the possibility of being available to one another emerges as the main affordance of this technology, and this emerges as an important possibility brought about by the mobile phone, which is changing the perception of the context in the eyes of those actors. This technology may give them the opportunity to reshape the way they do things on a daily basis, since it emerges "strongly connected with ingrained human perception of distance, power, status and identity" (Ling & Donner, 2009) which fosters a perception that goes further than and beyond its instrumental character, i.e. a machine that can be used to do things. This, it is claimed (Lister, Giddings,

Dovey, Grant, & Kelly, 2008, p. 253), bringing "profound transformations of everyday life, and the structures and relationships on which it is based" once as symbol it changes perceptions of status once just by "holding it up to one's ear and pretending to speak to a remote other may be sufficient to the user and no textual literacy is required" (idem). This is very relevant in what concerns the two tribes being studied. For instance, for the members of the Maasai tribe, which see the mobile phone as an artefact, it helps them to express their status quo; and for the Wasukuma it helps them to manage some of their relationships and dynamics when trading, and for both tribes the technology helps them to reinforce their position in the triadic interaction (producers-middlemen-buyer). This will be discussed in more detail in chapter 8 and 9. This is suggesting further analysis regarding the key concepts used in recent decades to characterise and analyse processes of technology adoption and integration in our daily routines. In setting up my analytical framework, I will be juggling with some important concepts emerging from Science and Technology Studies (STS), Development Informatics (DI), and Media and Communication (MC) and Development Studies (DS), such as appropriation, affordances and resilience.

So far it seems clear to me that the logic inherent in technology adoption may in some circumstances impact on the trajectory of a given artefact and consequently on the design process. However, things do not stop here: that would be too simplistic and linear. The conundrum is that the appropriation of those devices will generate meaningful transformations, which frequently are not possible to preview, and those transformations will reflect on the social and material culture of the actors immersed in a given context. The incorporation of those artefacts will set a new assemblage, and both structure and agency will be affected by the options made available, which will redefine the context and existing interrelationships and interactions, i.e. they will become "*encultured*" (Silverstone & Hirsh, 1992). This suggests me to try understanding the phenomenon under the *social learning* perspective, in which the appropriation and domestication concepts plays active role, once they enable possibilities of analyses from cultural point of view, which encompasses an anthropological or ethnographic perspective. This will make possible to look at how those objects are imbedded in different cultural settings and how those actors make sense (meaning) or the artefact to make it work (action).

In what concerns appropriation, it is suggested (Emily Martin, 1987, 1994) that the way users/communities make sense of scientific fact (or of artefacts) sometimes implies deconstruct it. However, this is not necessarily related to a conscious retaliation against the fact itself or the one promoting that fact or artefact. Rather, it corresponds to an attempt to "try to make sense of their own lives and relevant natural phenomena from their cultural framework, [mainly because without] meaning the artefacts remain artificial and alien" (Sorensen, 1996, p. 10). This flips the perspective to the other side of the coin, i.e. to the domestication perspective, which argues that "users are perceived as struggling with socio-material relationships that they seek or encounter in their everyday live, [and domestication] is a way of conceptualising that struggle" (Sorensen, 1996, p. 13). Therefore, to domesticate the artefact implies both to make the artefact to work (action) and to make sense (meaning), which infers *acquiring* (make accessible), *placing* (it physically), symbolically and mentally in order to be *interpreted* within the context, so it can be integrated into social practices taking place in the context of action.

Based on that, I will now lay down my analytical framework, describing how the concepts of *appropriation*, *affordance* and *resilience* will be used to inform my findings, and how their potential, complementarity, and key strengths can help me to interpret the adoption and use of mobile phones amongst the Maasai and the Wasukuma. On the other hand, it is also important to underline how any handicap in those approaches can influence my explanation. For now, I will just say that the degree of affordance and the level of appropriation will shape the resilience character of individuals and structures, because they are interconnected. I shall deal with this later.

Let me start by clarifying what we mean when we talk about appropriation. The term refers in the first instance to a degree of intentionality when someone engages with a given object, suggesting that one pay attention to what that thing will afford. Therefore, technology appropriation means the effort, which users make to fit the technology into their context of action, e.g. practices and routines. This suggests amongst other processes the recontextualisation of the technology when there is a shift from its context of design and production to its context of use. Consequently, recontextualisation emerges as an important aspect of the appropriation, which goes hand in hand with integration, or as Orlikowski puts it: "[in] using technology to

accomplish some task, users appropriate technological features […] and enact a set of social practices, which reinforce, adjust, or change the existing institutional properties [and arrangements, and sociocultural practices] (Orlikowski, Yates, Okamura & Fujimoto 1995. p.423).

Dourish (2003, p. 465), offers a more pragmatic view, suggesting that appropriation is "the process by which people adopt and adapt technology, fitting them into their working practices". This means that there is an active role of users in this process, which determines important changes in the way they perceive the context and inherent challenges and the struggles that they face, which will become more fluid and therefore possible to surf it. By this, I mean that they will have more chances to reroute the strategy when facing unexpected constraints. Pipek (2005) calls it "tailoring", which is done in accordance with the culture (organisational or local), the institutional practices and socioeconomic factors, and the technical infrastructure existing in the context of use. This will enable different ways and levels of appropriation and that will permanently change the perception regarding the material world, taking into consideration possibilities made available to suppress a given need or to finding a solution to a struggle in the course of doing a task or accomplishing a given process.

The above leads to a conclusion that both appropriation and affordance are intertwined, and that it is not possible to appropriate without visualising/disclosing an affordance. What the artefact can afford us with is the prime reason for the appropriation, the level of appropriation being dependent on the factors and resources existing in the context. This makes it possible to claim that the context is in permanent change, because the dynamic between appropriating and disclosing affordances determines a more fluid context, where the user can surf the affordance wave and extend the appropriation. That will allow the user to discover newer affordances in the device, therefore suggesting three dimensions where the affordance of a given artefact can be disclosed: i) user-artefact, ii) context-artefact, and iii) infrastructure-artefact. Those can emerge as interdependent or as independent phenomena, which will determine the degree of appropriation. I can suggest therefore that the relationship between appropriation and affordance may resemble the chicken-egg conundrum: since it is hard to determine the causality and establish what comes first. Therefore, I suggest, as an alternative, seeing this as a sort of loop, and paying more attention to what we can make use of in order

to stablish our relationship with the material world that surround us, and transform it in our benefit. This implies the redefinition of practices, beliefs, and relationships, which will open the door for one to see new affordances. Gibson (1979, p. 126) suggests that "what the object affords us is what we normally pay attention to". For example, my trainers (sports shoes) allow me both a slow and a fast run, and the same trainers can provide me with more resilience as the process of hybridisation increases. My car also enables me to move from one place to another, but also not to move at all, and just afford me a comfortable place, with sound, where I can sit and watch a movie if parked in a drive-in cinema. This suggests that technological appropriation, which implies discovering and exploring perceived affordances, is situational/contextual, i.e. the same artefact can disclose different affordances (see table 9 below) in different contexts, to address different needs. The dynamic between the appropriation process and disclosing affordability is like the two sides of a coin, the more we spin it the more they will become intertwined, and move to a different level of complexity, which will enable shifting from an adverse to a more favourable context of use. During the analysis of my empirical material, I will be looking for those types of affordances, confirming if they were disclosed and made use by those two groups of pastoralists.

AFFORDANCES LEVEL 1		REFERENCE
Unavailability	*Availability*	*(P. Dourish, 2004)*
Rigidity	*Flexibility*	*(R. Ling, 2005)*
Sedentary	*Mobility*	*(Pfaff, 2010)*
Limitable	*Illimitable*	*(Paul Dourish, 2003)*
Visibility	*Invisibility*	*(Ganesh, Deutch, & Schulte, 2016)*
Explicit	*Tacit*	*(Brézillon, 2003)*
AFFORDANCES LEVEL 2		REFERENCE
Inactivity	*Activity*	*(Carroll, Howard, Peck, & Murphy, 2003)*
Restrictable	*Unrestrictable*	*(Nyamba & Mlozi, 2012)*
Dependability	*Autonomy*	*(Geser, 2006; Tenhunen, 2008)*
Bargaining	*Negotiating*	*(Asongu, 2015)*
Interacting	*Collaborating*	*(Rich Ling & Lai, 2016)*
Micro-coordination	*Hyper-coordination*	*(R. Ling, 2005; R. Ling & Yttri, 2002)*

Table 9 –Typology of affordance

As such, when placing the mobile phone as the central element of the material world, it suggests an explanation as to how those three elements (affordance, appropriation, resilience) interlink and mutually shape each other. I call this the appropriation mechanism, which consists in understand how those two groups of users perceive the artefact, what it can allow them to do, how that will affect the way they see the context, and finally, what sort of implication the appropriation will bring to the way they interact with the others within the same context. The outcome may determine their flexibility and capacity to manage struggles and tolerate shock, i.e. to be resilient.

Therefore, to construct new understandings of the material world based on what the technology can afford us implies deconstructing previous sets of social and cultural arrangements. Consequently, it is important to underline that technology appropriation is not done without consequences, and it will affect everything: the technology itself, the user, the context, interactions, processes and institutions which exist and interplay in the material world. There is a sort of rearrangement of the old order that emerges with new options made available by disclosing new affordances, and a new order will emerge.

Subsequently, there will be important shifts, actors may change roles, and agencies may fluctuate from one side to another between two interdependent parts. In some circumstances the technology will be seen, and interpreted, as lying behind both its instrumental (Heidegger, 1977, p. 5), or symbolic (Haddon, 2003, p. 3; Hirsch & Silverstone, 2003, p. 2; Ling & Helmersen, 2000) character. Departing from Heidegger's prism, which suggests seeing technology as a way of getting things done, I will be able to interpret and try to understand the use those actors made of mobile phones. However, I must be aware that "appropriation is not just about the use of technology: it is also about the meaning the technology has for its user" (Mackay & Gillespie, 1992, p. 685), and this brings us to the symbolic domain of any object of the material world. Yung (*cf* in Ling & Helmersen, 2000, p. 350) suggests that:

> *"Symbolic values of artefacts are symbolic meanings and psychological links, which are often constructed, shared and reinforced through social practice and discourse in society. Not all mobile phone users share the same symbolic values of a technology, to a certain extent, because they do not share the same "everyday life", and therefore social practices as well as everyday discourses such as ordinary conversations and popular media, which often shape our assumptions of the world."*

The above suggestion is very important for gaining insights into those actors' world, namely to see how users' express status when using a given device. Ling & Helmersen (2000, p. 15) suggest that the "façade of the device, the type and its functions indicate something about the owner. Finally [and most importantly] the very ownership of a mobile telephone indicates that one is socially connected", and this, in my understanding, emerges as a key affordance, i.e. the possibility of being immersed in-the-world (Heidegger, 1996 [1927]). I believe that this is crucial to bear in mind, especially when looking at how key players within the livestock market act under that proposition, and how this affordance may enforce behaviour, and shape or shift agencies from one actor to another.

Therefore, those concepts will interplay and complement each other, forming a holistic tool – the appropriation ripple – which I believe will allow me to interpret my data in a more interconnected manner. It is expected that this will help to explain how the appropriation of mobile phones is changing perceptions regarding reality, namely perceptions regarding weather changes and lack of grasslands, which affects production, and the claimed lack of market information which impinges upon trade dynamics, thus making the affordance enclosed in the mobile to be perceived and disclosed differently across Arusha and the Lake Zone.

In conclusion, the analytical framework will help me to understand whether the mobile phone is being perceived as a tool for action or just as an object loaded with symbolic value, which determines that the self will be expressed differently. This will eventually give me the opportunity to see if an opportunity for action is being revealed and perceived differently by the same actors, in the same way, in different moments and facing different struggles. Or conversely, whether it is perceived differently by the same actor, or by different actors, within or across different contexts.

4.7. Concluding remarks

Resuming, I reemphasize that the recurrent use of linear approaches, and frequently top-down approaches, are two common aspects referred to in the literature as a key factor determining repeated ICT4D failures in LDC countries. To this, I can add the lack of a more consistent and frequent analysis of the context of use and users' requirements, which has generated detours in the ICT4D success rates. Thus, I would suggest converging affordance, appropriation and resilience as an analytical framework to refine the data collected and to interpret the technology society relationship. This is done with scholarships from the fields of DI (ICT4D 2.0) and STS (SST-MK2), all emphasizing the role of the user when reconfiguring and appropriating the technology according to their needs, therefore including their requirements during the design and policy making stages. I see this as critical to increase those actor's possibilities to appropriate the technological solution made available because it will make it easier to disclose and use the affordances enclosed in the technology. As said, when I introduced the first element of the analytical framework, this sort of feedback loop between cause-effect will generate a more resilient system. This is what my conceptual diagram (next page) aims to depict in a more integrative perspective, illustrating the interrelationship between those three concepts, where each affordance disclosed will enable a wave of opportunity, and that wave of opportunity will give the actors the chance to interpret the context as fluid and possible of being surfed. In a more cognitive and psychological perspective, the user´s 'skills' and 'willingness' plays important role, as they will allow actors to recodify the 'values' and 'meanings' embedded in the artefact and (re)interpret the 'symbolic' and 'instrumental' character of the technology, deciding to integrate, or not, that resource in their way of doing things, i.e. absorbing it into their practices and making them part of their cultural setting, this is what I mean by appropriation, which could be considered as more refined or extended enculturation. Concluding, and braced by all said previously, it seems not possible to conceive the appropriation as independent of the affordance process. Those two will always appear intertwined as two faces of the same coin, which overlaps generates important feedback loops, promoting retro-activeness. This will generate a dialectical process of cause-effect which will enact the third element: resilience, as presented in my analytical framework depicted on the next page.

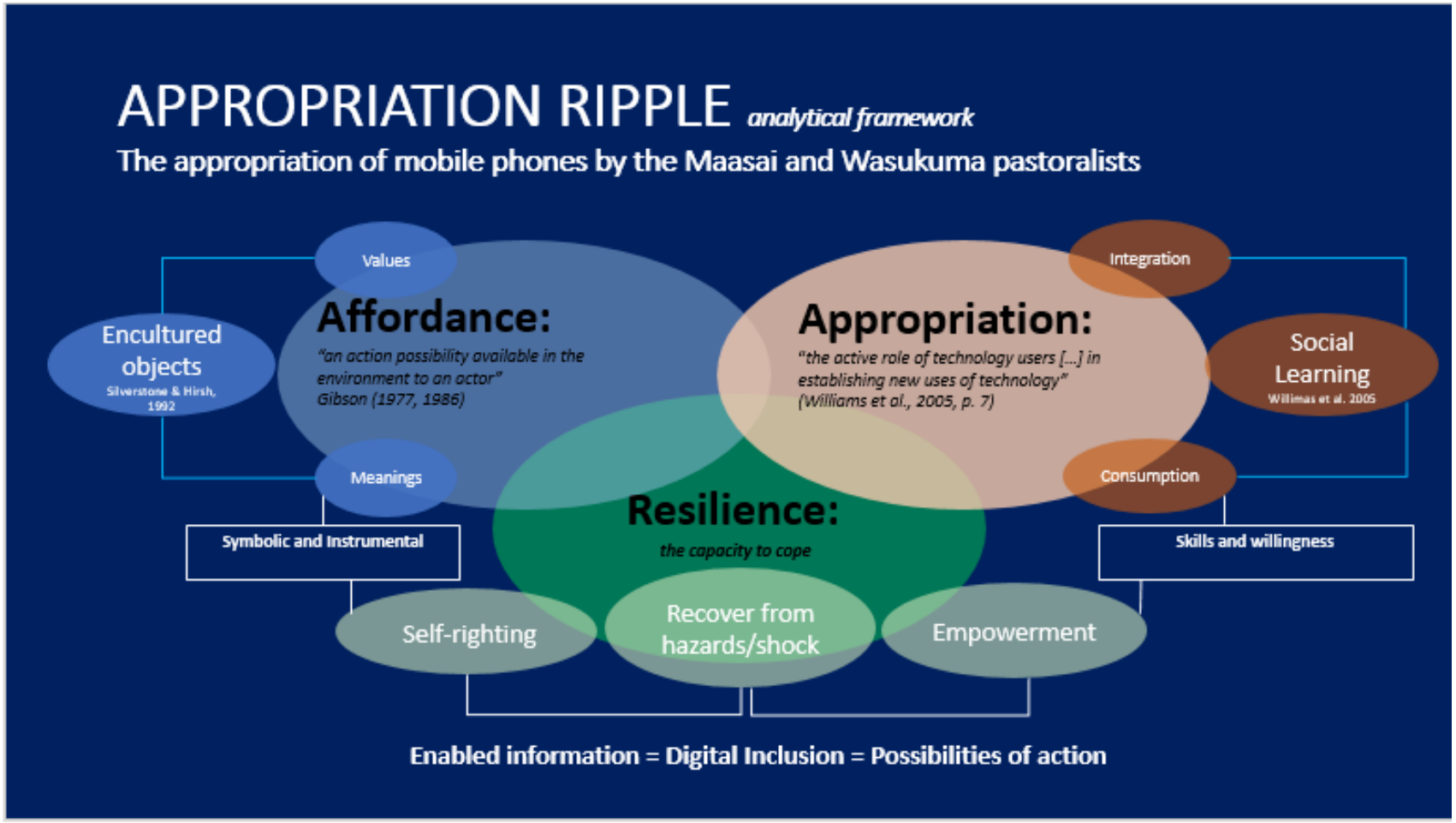


Figure 22 – Operationalising the three elements of the analytical framework

Chapter 5 – The importance of livestock sector in Tanzania and the contribution of ICTs for pastoralism

5.1. Introduction

The aim of this chapter is to analyse relevant documents and other policy instruments as a background for understanding the importance of livestock production for the Tanzanian economy, and to illustrate how ICTs can contribute to improving the sector. Throughout the chapter I will be emphasizing the case of Kenya and Tanzania which both adopted the Livestock Information Network and Knowledge System (LINKS) as an ICT infrastructure to implement changes in that agricultural sub-sector. This will constitute the background for my empirical section, where I bring out the voices of the key actors being researched and look at the ontological realities in the visions of those taking part in it. The chapter comprises six sections: the present introduction, then section 5.1.1. which will build an understanding of the importance of livestock in Tanzania. Section 5.1.2 will define pastoralism, and 5.1.3. will draw a perspective regarding the economic relevance of the livestock sector, which is followed by an introduction to some of the ideas regarding the development of that activity (5.2.). Section 5.3. will conclude the chapter.

5.1.1. Background to developing understanding of the importance of the Tanzanian Livestock Sector

This section aims to pinpoint some socioeconomic factors and triggers influencing livestock in order to build an understanding of livestock production in Tanzania. The livestock sector plays a critical role in the Tanzanian economy, pinpointed in the Tanzanian Development Vision 2025 (TDV) (Mkapa, 2005). The TDV clearly states that by 2025, Tanzania will have “attained a high quality of life; peace, tranquillity and national unity; good governance; an educated society imbued with an ambition to develop; and an economy which is competitive with sustained growth for the benefit of all people” (Mkapa, 2005, p. x). It prescribes specific goals for the livestock sector, detailed in an operational document – the National Livestock Policy 2006 (NLP).

The NLP 2006 was "formulated to address and articulate the needs of revitalising the sub-sector by pursuing macro and microeconomic policy reforms which are taking place in the country." (Njombe & Msanga, 2009, p. 1). The strategy laid-down in those documents outlines a vision and policy for the livestock sector, aiming to generate a shift from a more extensive to a semi-intensive mode of production. The NLP 2006 document emphasises the livestock sector as a source of both draft animal power and good-quality food. However, at present the livestock contribution to GDP is low, taking into account the potential for livestock keeping and the size of the cattle population, even though it is a crucial activity for many people.

Since the independence of Tanzania in 1961 agriculture has been the backbone of the Tanzanian economy, even if there have been some attempts to put an emphasis on other sectors such as mining and manufacturing. From 1986 until 1996 Tanzania was subject to two cycles of economic intervention promoted by the International Monetary Fund (IMF) and the World Bank (WB), trying to introduce a new "liberal international economic order" (Grosen & Coflkun, 2010, p. 54). During that decade Tanzania was forced to define new strategies to tackle the crisis. Some of these measures forced Tanzanian governments to shift the strategy used during the 1960s and 1970s, characterized by an intensification of the agricultural activity, and place more effort into mining and extraction, in order to attract foreign direct investment (FDI). However, the above strategy was never enough to change the pattern. Tanzania was, and still is, heavily dependent on agriculture, and this sector is the largest employment provider in the country. The Country Strategic Opportunities Programme (CSOP) report of the International Fund for Agricultural Development (IFAD), argues that:

> *"agriculture may contribute significantly to poverty reduction based on three factors:* ***(i)*** *the sector is the largest employer of labour;* ***(ii)*** *80 per cent of the poor are engaged in agricultural activities; and* ***(iii)*** *studies have shown that, because of the value added and the consumption multiplier effect, agricultural growth actually accounts for 60 per cent of the 5 per cent growth rate in GDP, which is twice the initial impact of the growth in the sector."* [41]

Side by side with those political decisions, climate, soil and rainfall play a determinant role in agriculture in Tanzania. Climate is predominantly tropical with some temperate

[41] http://operations.ifad.org/web/ifad/operations/country/home/tags/tanzania, accessed on 14/02/15

climates in isolated highlands. Temperatures range from 10ºC to 35ºC depending on altitude and season, usually cool from the end of May to the end of August. In the highlands, the temperature ranges between 10ºC and 20ºC during cold and hot seasons respectively. There is an ongoing debate regarding perceptions around weather changes, and this is raising more doubts and concerns for the agricultural sector at large since "trends already indicate that temperatures are rising, and rainfall is becoming more erratic. Recent models show that average annual temperatures will rise by 1ºC by 2050, and changes in rainfall patterns could cause dramatic shifts in agro-ecological zones" [42], which has led to calls for more action to be taken.

In order to mitigate those environmental changes, to increase resilience to environmental shocks, and acknowledging the degree of uncertainty brought about by different perceptions concerning weather changes and their implications, an intra-sectoral strategy was defined under the Agriculture Climate Resilience Plan (ACRP). This plan involved:

> *"experts in environment, climate change, land use planning, mechanization, hydrometeorology, soil science, water resource management, pest management, rural development and advocacy, among others, to work collaboratively to develop an action and investments that respond to the risks. [This was] tailored to fit the Tanzanian context from the policy level to the farm level."*[43]

One important resulting measure is the need to diversify crops as a strategy to make agriculture more sustainable when taking better account of natural resources. In this context, Tanzanian soils and soil fertility emerge as two factors contributing favourably to help agriculture to develop. For instance, in the Lake Zone a variety of soils can be found from sandy and loamy to hardpan and clayey soils of moderate to high fertility. This illustrates the potential of the Lake Zone for agricultural activity, including livestock production, in contrast to Arusha which is less diversified, much dryer, and consequently less fertile. The vast typology of soils, added to the tropical climate, opens up possibilities for diversification of crops, which can help Tanzania to

[42]Agriculture Climate Resilience Plan (2014 - 2019) – http://www.kilimo.go.tz/index.php/en/resources/view/tanzania-agriculture-climate-resilience-plan-20142019, accessed on 22/10/17

[43] Agriculture Climate Resilience Plan (2014 - 2019) – http://www.kilimo.go.tz/index.php/en/resources/view/tanzania-agriculture-climate-resilience-plan-20142019, accessed on 22/10/17

develop its agricultural potential, and enhance the competitiveness of other sub-sectors including livestock as suggested by the TDV 2025:

> *"By year 2025, there should be a participatory livestock sector, operating productive, commercially run, practicing sustainable livestock farming, with improved livestock, providing better employment, enhancing standards of living, supplying raw materials for industries, mainstreaming gender, increasing contribution to national income while protecting the environment". (Njombe & Msanga, 2009, p. 1).*

Nevertheless, the present low productivity of this sector is undeniable and the Livestock Sector Development Strategy (LSDS), mirroring the National Livestock Policy (NLP) of 2006, points out some of the reasons preventing the livestock sector from becoming more efficient. These include the lack of an adequate marketing infrastructure, and for that reason the implementation of a Strategic Intervention Area (SIA) plan could be of critical importance. Consequently, I will pinpoint some of the SIAs of the LSDS (Manyena, 2006) where the role of ICTs, namely the mobile phones, emerges as very important (see table 10 below).

❖ SIA1 suggests that "*immediate action is required to accelerate ongoing efforts to institute land use planning especially in districts with land use conflicts between pastoralists and crop farmers*";
❖ SIA 2 underlines that "*small livestock producers are poorly organized, which result in low bargaining power, limiting their sales, and high transactions costs that limit profitability for both producers and buyers";*
❖ SIA 3 highlights the "*need to control trans-boundary animal diseases (TADs) and diseases of economic importance*";
❖ SIA 4 argues in favour of "*capacity building and farmers empowerment";*
❖ SIA 5 emphasises the need for a "*national level institutional co-ordination*"
❖ SIA6 evokes the necessity of "*integrating needs of men and women and all vulnerable groups [and] bringing about equity and equal changes to access opportunities and control over resources for both men and women an all levels."*

Table 10: Strategic Intervention Areas of the Livestock Sector Development Strategy

5.1.2. Defining pastoralism and Agro-pastoralism

In order to understand their importance in East Africa, I will first define pastoralism and agro-pastoralism. According to Hesse and MacGregor (2006), defining pastoralism is problematic, the more so in East Africa where the pastoral systems are complex, diverse, and extremely dynamic, as pastoralists seek to adapt to evolving social, political and economic conditions at local, national and regional levels. Therefore:

> *"Pastoralism as a livelihood in Africa can take a number of forms, ranging from a truly nomadic to a mostly sedentary lifestyle, and from low to high stocking densities. Pastoralists keep a variety of different livestock, including cattle, sheep, goats, camels, and donkeys. Thus, 'pastoral management' can mean many different things. Moreover, most pastoralist systems are dynamic, responding to changing conditions brought about by bio-physical factors such as rainfall, as well as socio-economic factors such as access to markets, security issues, or changes in land tenure or lifestyle often imposed by outsiders." (Riginos et al., 2012, p. 3)*

Therefore, and to make it less complex, pastoralism can be defined as a mode of production where communities depend highly on mobile livestock keeping for their livelihoods, regardless of whether or not they also practise some sedentary production and life (agro-pastoralism). Pastoralism is also defined as a strategy to manage dryland ecosystems (Notenbaert et al., 2012, p. 2) and the livelihood objectives of pastoral communities in response to key environmental and drivers of change (Oba, 2011, p. 6). With regards to agro-pastoralism, it is a form of social organization based on the growing of crops and the raising of livestock as the primary means of economic activity. Halladay &Gilmour (1995, p. 76) describe this trend pointing out that:

> *"[many] previously pastoral communities now base their livelihood on settled agriculture and semi-pastoralism. i.e. agro-pastoralism. This [is due to changes] in land use [which] may affect the ecology of the rangelands in various ways. It may reduce biological diversity, which will accelerate environmental degradation and so threaten the future of both human and non-human life."*

There is no pure pastoral ideal. Some groups, such as the Maasai from Arusha, are heavily dependent on livestock for their livelihoods. Others, such as the Wasukuma from Lake Zone, have diversified agro activities while retaining some livestock. This make possible to say that Arusha is more traditionally based and pursues what is claimed as a line of continuity (Jandreau & Berkes, 2016); whereas in the Lake Zone the production strategy emerges as more aligned with modern techniques of livestock

production, even if some of them are the result of the improvement of old techniques, such as the *Ngitili* .While capturing this diversity in the form of an all-encompassing definition is difficult, most pastoral systems display, to varying degrees, a number of common characteristics as per table 11 below.

Table 11: Key characteristics common to different pastoral systems in East Africa

- **Families depend on livestock for a significant proportion of their food and income.**
- **Many pastoralists cultivate crops and carry out other economic activities to meet their subsistence needs.**
- **Livestock are raised for a mix of subsistence (particularly milk) and market needs (e.g. livestock sales to buy food, to pay taxes, etc.).**
- **Livestock herds are composed mainly of indigenous and cross-bred breeds.**
- **Livestock represent more than just economic assets. They are social, cultural and spiritual assets too.**
- **They define and provide social identity and security.**
- **Livestock are dependent on natural pastures for their diets including crop residues in some systems.**
- **Pastoralism depends on the work and expertise of all family members, usually divided by gender and age.**
- **Key livestock management strategies include: herd mobility, herd diversification, raising several species of animals in one herd, herd splitting, and maintenance of a high proportion of female livestock.**
- **Natural resources are managed through a mix of common property and private regimes where access pastures and water are negotiated and dependent on reciprocal arrangements.**
- **Pastoralism is characterised by adaptation and evolution to external constraints of climate, economic change and opportunities facing them.**

Table 11: Key characteristics common to different pastoral systems in East Africa. Source: Pastoralism: drylands' invisible asset (Hesse & MacGregor, 2006)

5.1.3. Economic relevance of pastoralism

It is estimated that over 90% of meat consumed in East Africa and more than 50% of the milk produced comes from pastoral herds. As a sector, pastoralism is worth US$800 million a year in Kenya alone. According to the International Institute for Environment and Development (IIED), existing data significantly undervalue the total economic value of pastoralism to national and regional economies. Statistics on nationally produced goods and services only reflect pastoralism's direct economic values (products like milk, meat, livestock, hides, leather and non-timber forest products, directly sold or sold as inputs to national and international supply chains). Behind this there is also the (indirect) added value of the herd as a form of insurance, savings and risk management, the development of social capital (absence of conflict and development of trust), the direct employment of up to 20 million East Africans, and finally skill development and benefits to the tourist industry. As such, understanding the different dynamics of the pastoralism drivers is crucial to the development of African economy because pastoralism is significant in eastern and western Africa, where approximately 50 million livestock producers support their families from livestock rearing, while contributing indirectly to the livelihoods of countless millions more through the livestock value chain (e.g. traders, shop-keepers, farmers, etc.) based on animals that are fed solely on natural dryland pastures. This sector is a crucial element of the economy of those countries. (see table 12 below).

Table 12: Pastoralism's estimated contribution to selected East African national economies in 2004	**Kenya**	**Tanzania**	**Uganda**
Contribution of agriculture to Gross Domestic Product	16%	45%	32%
Contribution of livestock to the agricultural GDP	50%	30%	19%
Percentage of indigenous cattle (an indicator of pastoralism) in national herd	75%	97%	95%

Table 12: Contribution of pastoralism to country GDP (Kenya, Tanzania and Uganda). Source - Modern and Mobile: The future of livestock production in Africa's drylands, IIED/SOS Sahel, 2010

5.2. Ideas regarding the evolution of the livestock market and the contribution of ICTs to its development

I now consider the role of ICTs in livestock marketing. I will first set my discourse in a more generic perspective, before focusing on the Tanzanian and Kenyan cases. The emergence of the livestock market as an institution in East Africa goes back to the 18th century. Ensminger (1996, p. 51) claims that the emergence of new economic institutions[44] created conditions for *markets* to evolve, namely when including "trade partnership such as the commenda[45], [which has made] considerable self-enforcement of contracts". This has played an important role in supporting the construction of a "collective consciousness" (Durkheim, 1893) resulting in a *more* "mechanical solidarity" (idem, p.81) This issue will be developed further in the section 7.3.3.

Nevertheless, when looking generically at livestock trade and at *market* activity in West Africa it is possible to note that traditionally those markets had "a weak institutional structure [which] commonly facilitates a monopsony situation": i.e. presence of one buyer (idem, p.27*)*. This helps to characterise largely the early forms of the 19th century that it was possible to have a more formal account of the existence of the market as an institution, as pointed out by the same author (idem, pp. 48-60).

Both Tanzania and Kenya have coherent economic, social and development strategies. Kenyan set up its own investment agency as a component of the strategy to achieve the country development blueprint covering the period 2008 to 2030[46]. Tanzania has developed a guide for "economic and social development efforts up to the year 2025" (Mkapa, 2005) which is operationalised through the National Strategy for Growth and Reduction of Poverty (NSGRP), where the livestock trade emerges as a strategic economic niche to be developed, since it has proven to be "resilient and resourceful in adapting to a host of political challenges" (Mahmoud, 2010, p. 2).

[44] "*Institutions are the rules of the game in a society, or more formally, are the humanly devised constraints that shape human interaction. In consequence they structure incentives in human exchange, whether political, social, or economic…*" (North, 1990, pp. 3-4 *cf* in Ensminger, 1996, p.5)
[45] A credit system introduced by Muslims in East Africa
[46] http://www.investmentkenya.com/index.php?option=com_content&view=article&id=46:kenya-vision-2030&catid=13&Itemid=148. Accessed on 06/01/18

5.2.1. Evidence for understanding the importance of ICTs in the Tanzanian livestock market

The last two decades have witnessed a massive increase in the use of ICTs throughout Africa. For example, it is expected that by the year 2020 the level of mobile internet use will reach 38% and the number of connections mobile to mobile (M2M) will reach the astonishing number of 26 million[47].While less than three percent of rural areas in Africa have landline telephone connection, the International Telecommunication Union (ITU) estimates that over 40 percent of these areas have phone access via cell phone"[48]. In Tanzania, there is presently a penetration rate of 36% and it is expected that by 2018 the number of subscriptions will rise to 40 million (fig. 23 below).

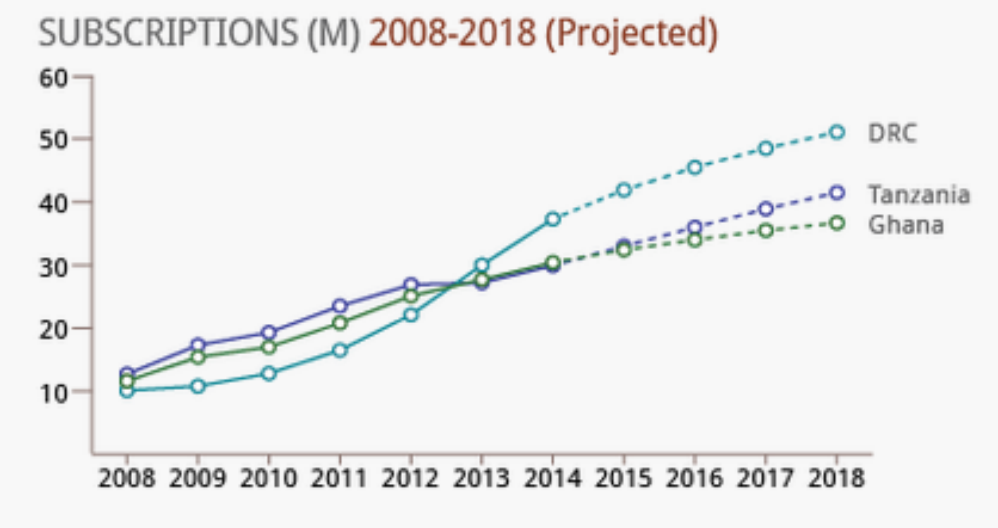


Figure 23: Mobile phones penetration Rates projection until 2018, Source: GMSA Intelligence, IMF

Mobile phone technology has been accepted in almost all communities. It has managed to transcend the geographical, socio-cultural and economic barriers known to hinder the adoption of many other technologies and innovations as discussed in chapter 4. User strategies to overcome constraints from the lack of adequate socio-technical infrastructure determine this process, and illustrate that those actors can have an active role in appropriating the technology (Maail, 2011; Stewart & Williams, 2005) through an active reconfiguration process.

[47] https://www.gsma.com/mobileeconomy/africa/, accessed on 17/09/2017
[48] http://ipsnews.net/news.asp?idnews=52677 – accessed on 31/01.2012

In this context, mobile phones emerge as a key technology which is being used even by poor and conservative communities like pastoralists in rural Africa. For that reason, I think it is important to investigate and explain the implications of mobile communication use in the livestock sub-sector. That led to my focus on this sub-sector, to study the new socio-dynamics of this activity, and to understand the market trends and pastoralist behaviour with mobile technologies; Tanzania being a highly relevant country to conduct such a study given the importance of livestock keeping and pastoralism.

Recent decades have seen important changes in the livestock market as monopsony has been disrupted, mainly with the spread and use of ICTs for socioeconomic purposes. The National Livestock Policy states that since “mid 1980’s, Tanzanian economy has been undergoing gradual and fundamental transformations towards a market-based economy”. This has opened up avenues for more participants and for the creation of more formal livestock trade.

Livestock keeping, mainly pastoralism, includes specific particularities, such as mobility, that produce synergies as well as tensions, with other types of land use. One example is the relation between pastoralism and the dynamics of dry land management. It has been claimed that mobility and herd mobility are key elements of any strategy in biodiversity management. They allow the sustainable use of the drylands, taking into consideration that the survival of herds depends on the pastoralists' willingness and capacity to move (Hesse & MacGregor, 2006; Nassef, Anderson, & Hesse, 2009). But there has been more legislation (the policy of corridors) implemented, which is constraining the freedom to move, even if the Tanzania Development Vision for 2025 states that by the year 2025, there should be a livestock sector, which to a large extent shall be commercially run, modern and sustainable. This is addressed as one of the specific objectives in the National Livestock Policy (NLP): suggesting a need to “strengthen technical support services, develop and disseminate new technologies” (idem, p.11).

However, it has been claimed that “[i]nadequate livestock farmers’ knowledge and skills is one of the limiting factors to the development of this industry. Knowledge and skills is important for quick adoption of appropriate technology, which has been

developed and disseminated to livestock farmers" (MLD, 2006, p. 7). It is relevant then to understand in a broad sense what role science and technology could play in promoting changes, and specifically the role that ICTs could play if livestock actors can appropriate those tools to overcome their problems of lack of resources and infrastructure to gain access to markets.

There are claims that emphasize the positive outcomes of the use of mobile phones in the activities of pastoralism, livestock and livelihoods in East Africa. The sustainable use of the drylands contributes "considerably to national economies and to society, as they support agriculture, livestock rearing, tourism and wild resource harvesting, [playing also] a critical role in ensuring national food sufficiency" (Nassef et al., 2009, p. 1). Mobility is critical, and in the search for pastures in times of abundance, mobile phones play a relevant role, even if the "mobility for production is fundamentally different from the mobility as a coping strategy aimed at minimizing the negative effects of drought, epidemics, or conflict" (Krätli, Huelsebusch, Brooks, & Kaufmann, 2013, p. 44), which can be illustrated as the particular strategies of the Wasukuma (mobility for production) and the Maasai (mobility as a coping strategy) respectively.

This strategic use of mobile phones to overcome environmental and seasonal issues is much more critical in market strategies. For instance, Nassef et al., (2009, p. 20) cited in Hesse and MacGregor state that:

> *"[a]ccess to markets, bargaining power and enabling services (credit and livestock insurance) are crucial to increase pastoralists' market participation and thereby release the full economic potential of the pastoralist system. [In addition,] values of non-market goods and services need to be measured and expressed in monetary terms, when this is possible and appropriate, so that they can be weighed on the same scale as commercially traded components", (Hesse & MacGregor, 2006, p. 4).*

That implies shifting the market from a more informal to a more formal basis. I would reinforce this perspective, mainly taking into account that many rural people from Tanzania are still "people of cattle", such as the Maasai (Katherine Homewood, Kristjanson, & Trench, 2009, p. 217), who have extensive pastoralism as their *modus vivendi* and are still being exposed to market speculation. Those authors suggested that, "more recently, the private sector has expanded in terms of providing some basic transport, animal health and other services. [Also, that local] commerce has long

centred on livestock, with proximity to the border creating price gradients profitable to traders" (idem), but apparently, not being enough to radically change things.

It is in this aspect of markets where I focused because the mobile phone is here highly relevant, supported with adequate infrastructure such as communication towers, with potentially a significant contribution towards the restructuring of the livestock market and consequently to the transforming of pastoralists' livelihoods.

It has been claimed (J.G. McPeak & Little, 2006, p. 203) that ICTs could play a fundamental role in the implementation of these changes. Solutions such as market information systems are already helping pastoralists to face some of those challenges and increasing their involvement in inter-regional cattle markets for instance. These authors claim that through market information systems it is possible to manage livestock marketing, providing "livestock price/volume and related information on forage conditions, disease, conflict and water supply in selected markets in the pastoral regions of Eastern Africa (Kenya, Tanzania and Ethiopia)" (Kariuki & Kaitho, 2006). These have been for generations some of the major issues contributing to the decline of pastoralism and the drylands.

Souter *et al.* (2005, p. 115) suggest that telecommunications can "help producers, intermediaries, and consumers to increase information about the availability and price of goods, thus enhancing market performance", nevertheless Molony advises that future studies "should benefit from survey work in communities that do not yet have mobile coverage to see how networks changes when mobile phones are adopted for the first time in business" (Molony, 2006). Therefore, it seems likely that there is still work to be done in what regards the use of ICT in livestock marketing.

Those are some key aspects of the impact of ICT uses in East Africa to be explored, with evidence showing that the use of ICTs by SMEs in this region has been a trend since the late 90s, with a particular emphasis on mobile phones in Tanzania. Evidence also suggests that ICTs are reshaping the structure of the SME sector; however, it is also important to understand how this is affecting the performance of individual entrepreneurs and producers. There are some claims suggesting that it has increased flexibility and autonomy in the decision-making process, which generates "implications for the efficiency [and] productivity […]. In this context, the key role of

ICT is that they may be used to acquire and process information and reduce uncertainty" (Matambalya & Wolf, 2001, pp. 12-13). Therefore, can lessons be taken from the SMEs context and used in the livestock sector? The answer points to indicators suggesting that increased access to information is already contributing to some changes within the rural context. For instance, Matotay and Furuholt (2010) tried to understand how access to information, facilitated by increased use of mobile phones, contributes to empower smallholder farmers in Babati District in Tanzania, helping them to reduce vulnerability to risk. The study concludes that "[e]nhanced access to market information via mobile phone has lifted up the amount of opportunities available. These positive changes have led to higher monetary income for the farmers and in turn improved the livelihood indicators." (Matotay & Furuholt, 2010, p. 109).

Similar conclusions were produced by Meera and Andrew (2006, p. 3) when stating that "[a]gricultural information portals (e-agriculture) in general can provide messaging system, easy access to agricultural information and discussion forums", in order to empower farmers. Closing, I believe that "ICT policies for all African nations need to be reviewed" (Meera & Andrew, 2006, p.6), concluding that rural "Africa's economic scale can improve with the growth of communication industry, electronic industry, internet users, software industry and the business market related to these industries" (Meera & Andrew, 2006, p. 9).

> *"[As such I would underline that] the mobile phones contribute to reduce poverty and improve rural livelihoods through a number of ways. First, by expanding and strengthening social networks; increase people's ability to deal with emergencies and to work together thereby reducing costs and increasing productivity. Secondly, mobile phones enable rural people to cut down travel costs; minimize physical risks; maximize the outcomes of necessary journeys; increase temporal accessibility; amplify efficiency of activities; and send and receive money. Thirdly, mobile phones help rural traders and farmers to secure better markets and prices; save time and money; and promptly communicate business-related information." (Sife, Kiondo, & Lyimo-Macha, 2010, p. 13).*

5.3. Concluding remarks

Agro-pastoralism and pastoralism have an important role in the Tanzania economy, so it is important to strengthen the livestock sub-sector. Njombe & Msanga (2010) state that there is a need to scale up current transformations in order to stimulate further growth mainly because the population is still increasing, and also the demand for food security. However, concerning pastoralists in the rural areas of Tanzania, I believe that the mobile phone (Gaver, 1991, p. 81) can enable more than that. It is reshaping the market structure through the generation of new flows of communications among pastoralists, intermediaries and the market.

In concluding the introductory part of the thesis, I underline that the previous two chapters attempt to provide evidence for the study of the role of mobile phones within the livestock sub-sector in Tanzania. Pastoralists are now more involved in the livestock market. I believe that this has been helped by the incremental use of mobile phones. The possibilities generated by this technology seem to be reshaping not only pastoralists' potential and behaviour, but also intermediaries' actions and the market's performance. These reasons underline why I think it is important to carry out this research and try to understand, and explain, the changes in livestock production and marketing, the interactions amongst key actors, and how this contributes to changes in those actors' livelihoods, and more generally, how the discourses of modernisation and development are being presently understood.

Chapter 6 – The history and evolution of the Livestock Information Network and Knowledge System (LINKS) in East Africa

6.1. Introduction

This chapter draws a retrospective of the LINKS implementation, portraying its evolution from the early stage of the global livestock collaborative research support programme to an official service in three countries in East Africa: Ethiopia, Kenya and Tanzania. I will examine its implementation in Tanzania and try to portray the process going back to the early years of the project and support the narrative with accounts from key actors involved in the setting up process, to which I will add information collected from official documents consulted in the Ministry of Industry Trade and Marketing.

The chapter comprises five sections, 6.1. being the introduction. The LINKS history will be described between sections 6.2. and 6.4., where I will underline the importance of projects such as the Livestock Early Warning System (LEWS) and the National Livestock Marketing Information System (NLMIS) as tools for monitoring, analysing and communicating drought conditions and market information, which are the predecessors of LINKS. In section 6.3. I will review the LINKS implementation in Kenya, and 6.4. in Tanzania, pointing out the major change from a project to a service, and key moments regarding the roll-out process in Tanzania, from the early stage of a project until it becomes a formal service and institutional tool aiming to transform the livestock sector in Tanzania. Section 6.4.1. will introduce a more technical discussion and briefly describe the architecture and design of LINKS. In the next section (6.5.), I point out some of the reasons preventing LINKS uptake and underline how mobile phones are supplementing the institutionalisation of the sociotechnical arena, and what are the implications for LINKS. Concluding this chapter, I will create the background for the three chapters that will follow whose aims are to underline constraints, dynamics, market and production systems, and to describe the implication of the mobile phone use among pastoralists and agro-pastoralists.

6.2. The emergence and evolution of the Livestock Information Network and Knowledge System (LINKS) in Ethiopia, Kenya and Tanzania

The Livestock Information Network and Knowledge System (LINKS[49]) is a service in three countries in East Africa, namely Ethiopia, Kenya and Tanzania. The system was initially established in Ethiopia. In October 2005 the Livestock Information Network & Knowledge System (LINKS) for Enhanced Pastoral Livelihoods in East Africa, led by Texas Agricultural & Mechanical University (TAMU), in partnership with USAID, helped to set up the Pastoralist Livelihoods Initiative (PLI) in Ethiopia. The strategy was to try and tackle famine and cattle mortality resulting from a massive drought that struck that country in previous years, trying to prevent the escalation of vulnerability to drought by "identifying feasible interventions to convert mortality losses into marketed offtake[50]"[and developing strategies for livestock keepers to] destock their animals in a proactive manner."[51] In order to introduce the system as a service in Tanzania I will need to place myself as far back as 1997, when a project under the leadership of the USAID Global Livestock Collaborative Research Support Program (GL-CRSP)[52] was brought to those three countries in East Africa through a project called the Livestock Early Warning System (LEWS). This was an eastern Africa project "which culminated in the development of spatial models for assessing and forecasting forage situation as the basis for providing early warning information for livestock-based production systems."[53] Thus, the Early Warning System (EWS) was

[49] LINKS is both the name of a service providing marketing information regarding livestock prices and the name of a research project within Texas A&M University, USA, where the service was developed initially as a tool kit called Livestock Early Warning System. In Tanzania the service is called LINKS and in Kenya it is NLMIS.
[50] cnrit.tamu.edu/lews/papers/TRANSFORM_LEWS_LINKS.ppt, accessed on 03/07/16
[51] http://cnrit.tamu.edu/lews/papers/LEWS_Brochure.pdf, accessed on 03/07/16
[52] "Global Livestock CRSP global program builds effectively on complementarities between projects in different regions. Centered on a theme of managing risk in our unpredictable world, the program is developing the capacity to predict risk so it can be better managed, improving the tools to cope with risk, and contributing to the mediation of risk. The GL-CRSP has chosen to work in ecosystems and regions where human populations and natural resources are most vulnerable, and in most cases, where biodiversity is most valuable. The GL-CRSP focuses on human nutrition, economic growth, environment and policy related to animal agriculture and linked by a global theme of managing risk in a changing environment." http://crsps.net/resource/global-livestock-crsp-annual-report-2005/ accessed on 11/07/16
[53] http://crsps.net/resource/application-of-information-communication-technology-in-developing-a-national-livestock-marketing-information-system-the-case-of-kenya/ accessed on 11/07/16

developed, tested, established and managed "region-wide district-based pastoral EWSs [(Early Warning Systems)]. This was linked to appropriate early responses through a food and livelihood security monitoring, reporting, analysis, and dissemination system,"[54] *which* determined its extension to Kenya in 2007, and there after being technically upgraded, it became known as the Livestock Early Warning System (LEWS). The LEWS project was then developed and built upon a Global Telecommunications System (GTS) to provide a regional decision-support framework for livestock early warning information (Kariuki & Kaitho, 2006). LEWS was supported in a "communication technology package where real-time satellite weather data is used to drive a biophysical model known as PHYGROW (Phytomass Growth Simulator, fig. 15) to produce daily estimates of forage conditions every 10 days with up to 90-day forecasts since 1999."[55]

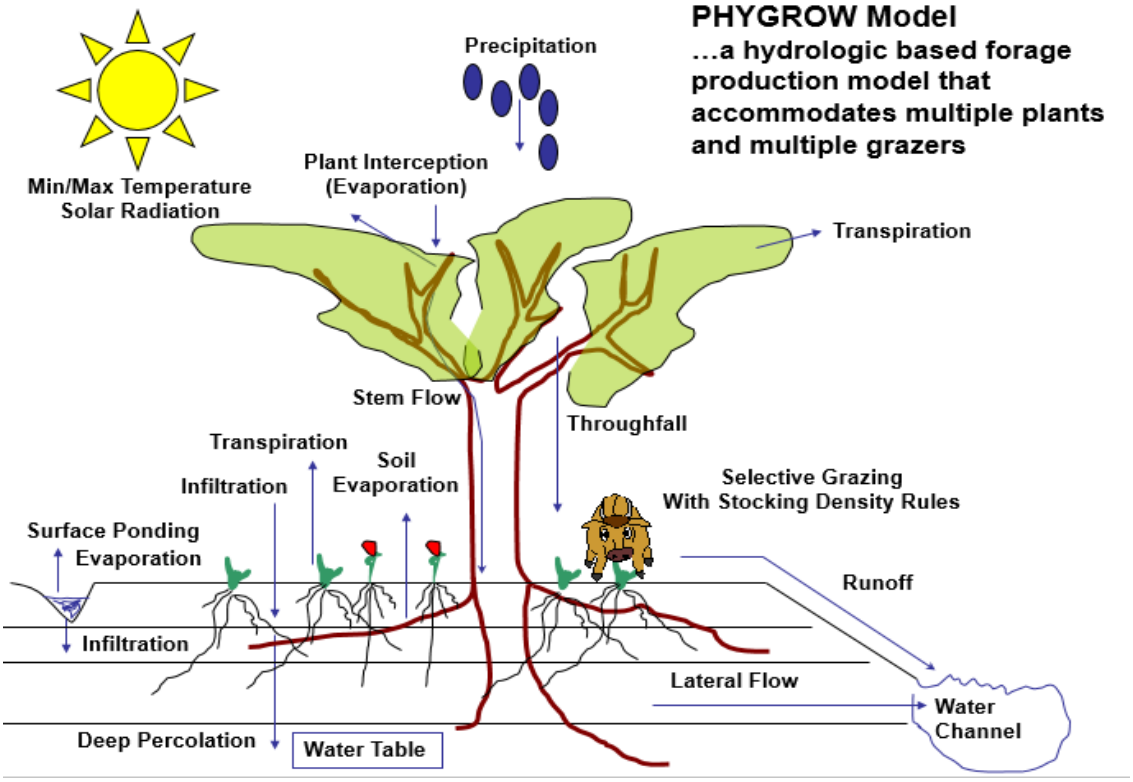


Figure 24: PHYGROW Model – Transformation of the LEWS Program to a Livestock Information Network & Knowledge System (LINKS). Source Texas A&M University[56]

[54] http://crsps.net/resource/expansion-of-lews-activities-in-ethiopia-under-the-pastoralist-livelihoods-initiative-pli/, accessed on 02/07/16
[55] See http://crsps.net/wp-content/downloads/Global%20Livestock/Inventoried%207.16/2-2006-2-182.pdf, accessed in 28/05/15
[56] cnrit.tamu.edu/lews/papers/TRANSFORM_LEWS_LINKS.ppt, accessed on 03/07/16

The base of what is known nowadays as LINKS is LEWS, to which the marketing information component was added when the project was set up in Kenya. This has enhanced the project, and enabled it to disseminate important market information, whose aim was to develop relationships amongst livestock authorities, agencies and livestock marketing associations. This very rapidly became a reality, and as well as a demand, as per quote of Dr Robert Kaitho, an Associate Research Scientist of the Department of Rangeland Ecology and Management at Texas A&M University, College Station, Texas, USA, who was the Kenya/Tanzania LINKS coordinator at the early years of the project:

> *"After consultations and collective evaluation of the system, it was unanimously agreed that the underlying technology be adopted to develop a national livestock marketing information system […]."(G. K. Kariuki, R. , 2008).*

In the Kenyan case, the pilot project was shared with key stakeholders, mainly with actors in the policy-making arena, who agreed to implement the system, and develop the National Livestock Marketing Information System (NLMIS). The main goal was to try to cover as many nodes as possible in a network of key and remote livestock markets in Kenya as we will see in more detail in the next section[57]. The project main goals were to:

> *"avail information through various media to all players in livestock marketing, establish a livestock marketing database for reference in planning, research and monitoring of marketing trends, and to provide early warning information for disaster preparedness"[58], [the latter being the key component of LEWS that remained in the new version of LINKS]".*

[57] This short and condensed resume corresponds to some work done initially in the Ministry of Industry, Trade and Marketing where I had the opportunity to consult some archives and other official documents made available. The information collected there was latter checked and polished using other source of information such as the web sites of key partners involved in the development of this resource, amongst them the Texas A&M University and the Innovation Labs and CRSPs.

[58] Full paper in: http://crsps.net/wp-content/downloads/Global%20Livestock/Inventoried%207.16/2-2006-2-182.pdf, accessed on 27/05/15

6.3. LINKS: from research project to a National Livestock Marketing Information Service: the Kenyan case

Focusing now more particularly on the Kenyan case, I can underline that the shift from a project-based initiative (LEWS/LINKS) to a service (NLMIS) brought both practical and institutional implications. Issues of coordination emerged, as the number of players increased. It is suggested that during the late stage of LINKS as a project in Kenya there were over 61 representatives from government, NGOs, private consultants, and traders involved. The majority of them had participated in training sessions aiming to develop skills in data collection and dissemination through ICTs (Mobile phones + SMS, and computer-based internet).

Returning to the initial stage of the programme, in 2003 after approximately a decade of failed attempts to generate useful information and communication tools for traders, a pilot module was designed for reporting livestock prices in Kenya. Two markets were chosen to take part in the trial, Garrisa[59] and Isolo, Nairobi being the final destination of live animals. Members of the Ministry of Livestock and Fisheries Development of the Republic of Kenya were trained and provided with mobile phones in order to report data collected using the SMS to code alphanumeric messages to send to a number that communicates with the server. After a round of initial tests and stabilization of the system, another three *markets* – Moyale, Wajir, and Marsabit – were added to the chain.[60]

There were key institutions involved in this new project: NLMIS – Kenya, which was formally launched on the 31st July 2007. This important group of actors included the

[59] Among a variety of activities aiming to promote LINKS the field day held at Garissa, market (Kenya) on the 25 May 2005 was significant in helping to promote the initiative, and eventually to change the LEWS/LINKS project into a service (NLMIS). In that initiative over 500 posters and information flyers were distributed, with information to help demonstrate the use of the LINKS system, to traders, keepers, local government, county councils and NGOs. This strategy was complemented by a training session of 14 users with access to the internet. To complement that strategy, workshops were held in key districts such as Isiolo, Marsabit, Moyale, Mandera, Wajir, Garissa, Samburu, Baringo, Wets Pokot, Turkana, Kilifi, Kajiado, Narok, and Laikipia. Altogether 308 participants were involved, representing public and private sectors. This constituted one major strategy to mobilize stakeholders from different markets and districts to help promote and expand NLMIS.

[60] Source http://crsps.net/wp-content/downloads/Global%20Livestock/Inventoried%207.16/2-2008-2-188.pdf, accessed on 12/07/16

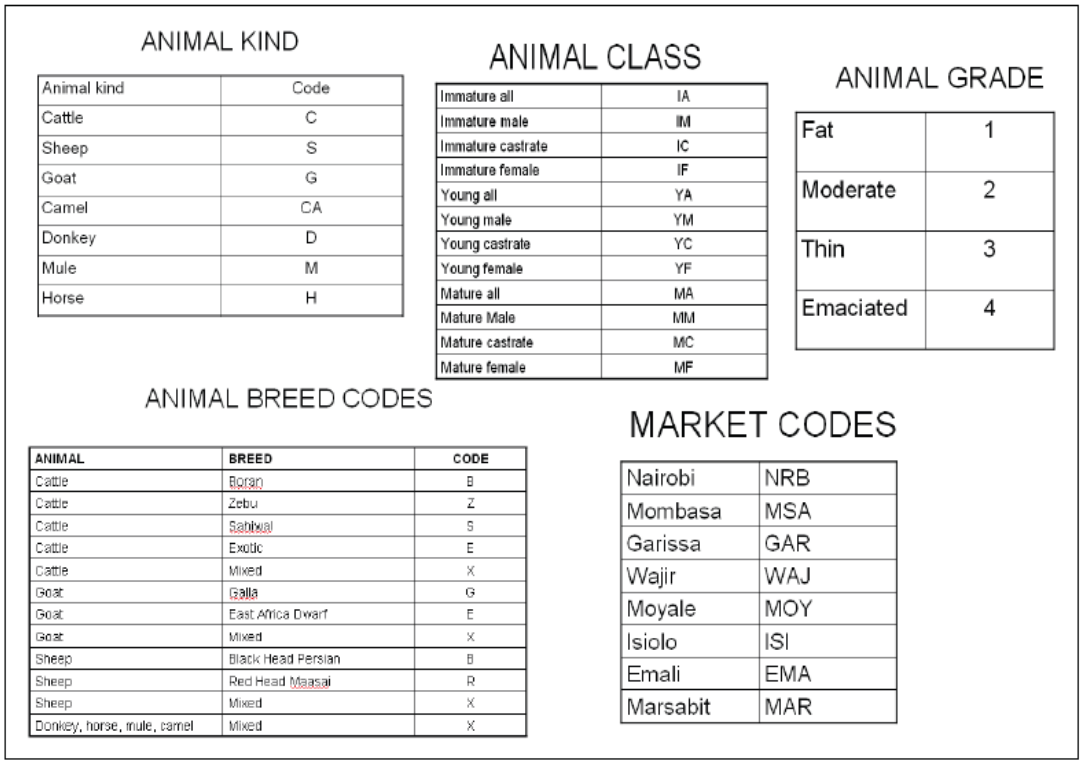
Ministry of Livestock and Fisheries Development of the Republic of Kenya, Kenya Livestock Marketing Council, FARM-Africa, Food and Agriculture Organization, Veterinaires Sans Frontiers (VSF-Suisse), Food for the Hungry International (FHI), and Terra Nuova Kenya. The administrative structure of NLMIS was constituted by a committee of entities with interest in livestock marketing information and headed by the Livestock Marketing Services Division of the Kenyan Ministry of Livestock and Fisheries Development, which was given the mission to administrate and coordinate the system and the network of livestock marketing officers and data monitors.

In operational terms, the data collection process would be the responsibility of the district livestock-marketing officers, in charge of supervising at district level. Those officers would have as their main responsibility not only the supervision of the data collection process, in order to ensure consistency and accuracy of the information collected, but also safeguarding that the raw data would be timeously reported. The success of the service would depend largely on this task.

In parallel, the NLMIS market monitors would have some other important responsibilities added, and among them I would underline the need to code according to a coding system (please see figure in the next page) and text the information collected to the headquarters – ministry – where the central database[61] was allocated.

In the next page, I present the coding system matrix that was used initially in Kenya to support the livestock marketing officers to collect and codify the information that would feed the system. This matrix includes five categories: animal kind; class; grade; breed, and the market code, which would also be the base for the coding system on which the Short Message System (SMS)[62] would rely to disseminate marketing information to key stakeholders.

[61] (http://www.lmiske.net)
[62] We will introduce latter in this chapter the SMS coding system



ANIMAL KIND

Animal kind	Code
Cattle	C
Sheep	S
Goat	G
Camel	CA
Donkey	D
Mule	M
Horse	H

ANIMAL CLASS

Immature all	IA
Immature male	IM
Immature castrate	IC
Immature female	IF
Young all	YA
Young male	YM
Young castrate	YC
Young female	YF
Mature all	MA
Mature Male	MM
Mature castrate	MC
Mature female	MF

ANIMAL GRADE

Fat	1
Moderate	2
Thin	3
Emaciated	4

ANIMAL BREED CODES

ANIMAL	BREED	CODE
Cattle	Boran	B
Cattle	Zebu	Z
Cattle	Sahiwal	S
Cattle	Exotic	E
Cattle	Mixed	X
Goat	Galla	G
Goat	East Africa Dwarf	E
Goat	Mixed	X
Sheep	Black Head Persian	B
Sheep	Red Head Maasai	R
Sheep	Mixed	X
Donkey, horse, mule, camel	Mixed	X

MARKET CODES

Nairobi	NRB
Mombasa	MSA
Garissa	GAR
Wajir	WAJ
Moyale	MOY
Isiolo	ISI
Emali	EMA
Marsabit	MAR

Figure 25: Initial coding system used in Kenya - source GLCRSP, annual report 2005

As noted initially, a number of governmental and non-governmental organizations were among the many actors involved in the implementation of NLMIS in Kenya. They had as their mission to support the tasks such as the access to *markets*, and the data collection and dissemination process. Robert Kaitho was pointed out as a pivotal player in setting up the project and coordinating the implementation process in both Kenya and Tanzania, coordinating players from the public and private arena acting in the field, such as the NGOs and donor agencies.

In that respect, I found evidence suggesting that the coordination of the collaborators was pointed out as one of the main challenges faced during the implementation stage, which needed to be properly addressed in order to keep the project implantation on track. According to Mr Manumbu[63], when reporting the Kenya case as an example, he pointed out that "*the sustainability of the system was ensured during those workshops*", which allowed for a total of 31 other markets to be identified and included in the NLMIS markets monitoring network. This would later be upgraded with

[63] In an informal conversation, we had during one of the view visits I did to the Ministry of Trade to consult some documents/material made available.

nominated persons to be trained as market monitors and generate a total of 20 supervisors that would monitor the network of markets taking part in NLMIS. The result was not only the scaling of the project but most importantly the development of a proposal to expand the system further and to other countries, such as Tanzania.

I now present a 'translation terrain' (Williams et al., 2005) map (please see figure 26 below) of the network of actors (human and non-human) that gave body to the LINKS system in Kenya, as well as the geographic map with the monitored markets taking part in LINKS at the initial stage in both Kenya and Tanzania (please see figure 27, next page).

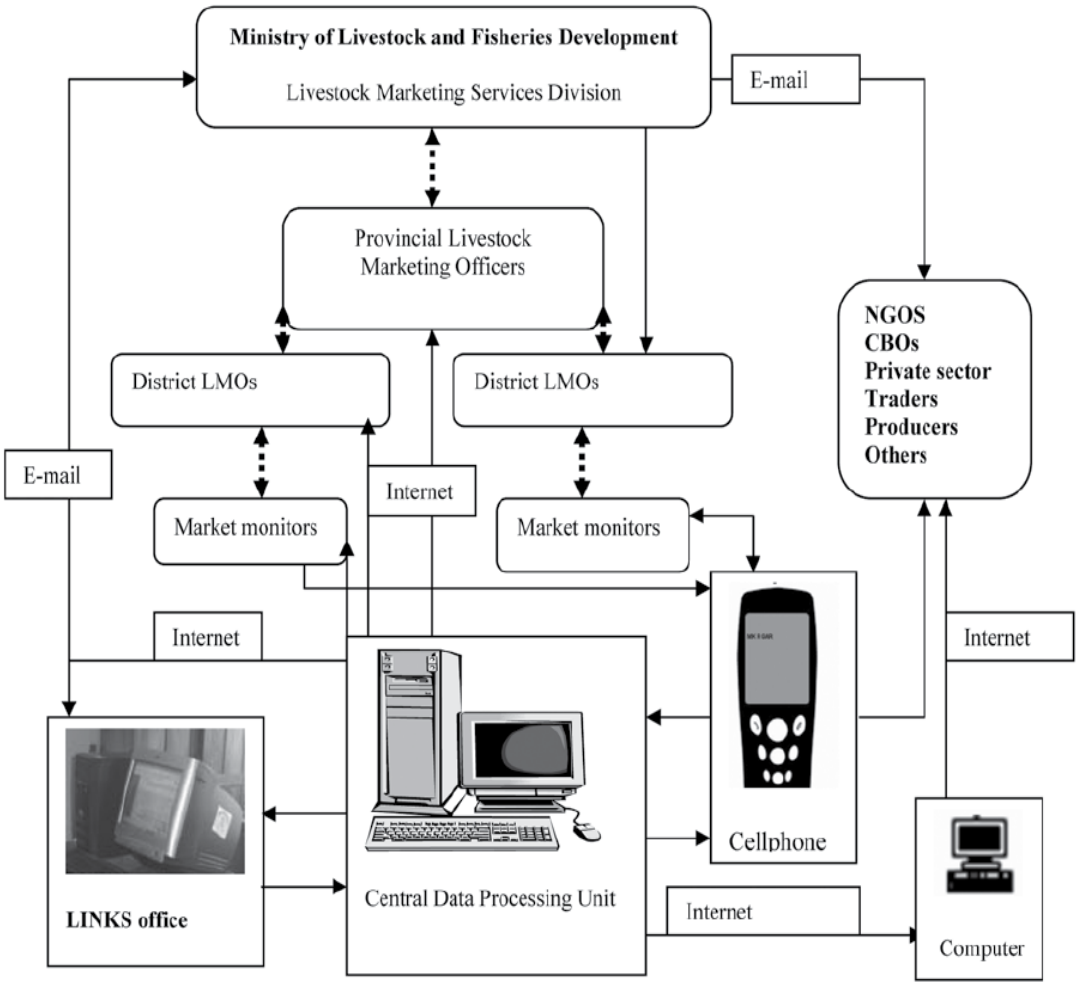


Figure 26: Network of actors (human and non-human) that gave body to the LINKS system in Kenya. Source: http://crsps.net/wp-content/downloads/Global%20Livestock/Inventoried%207.16/2-2006-2-182.pdf, visited, 13.02.2017

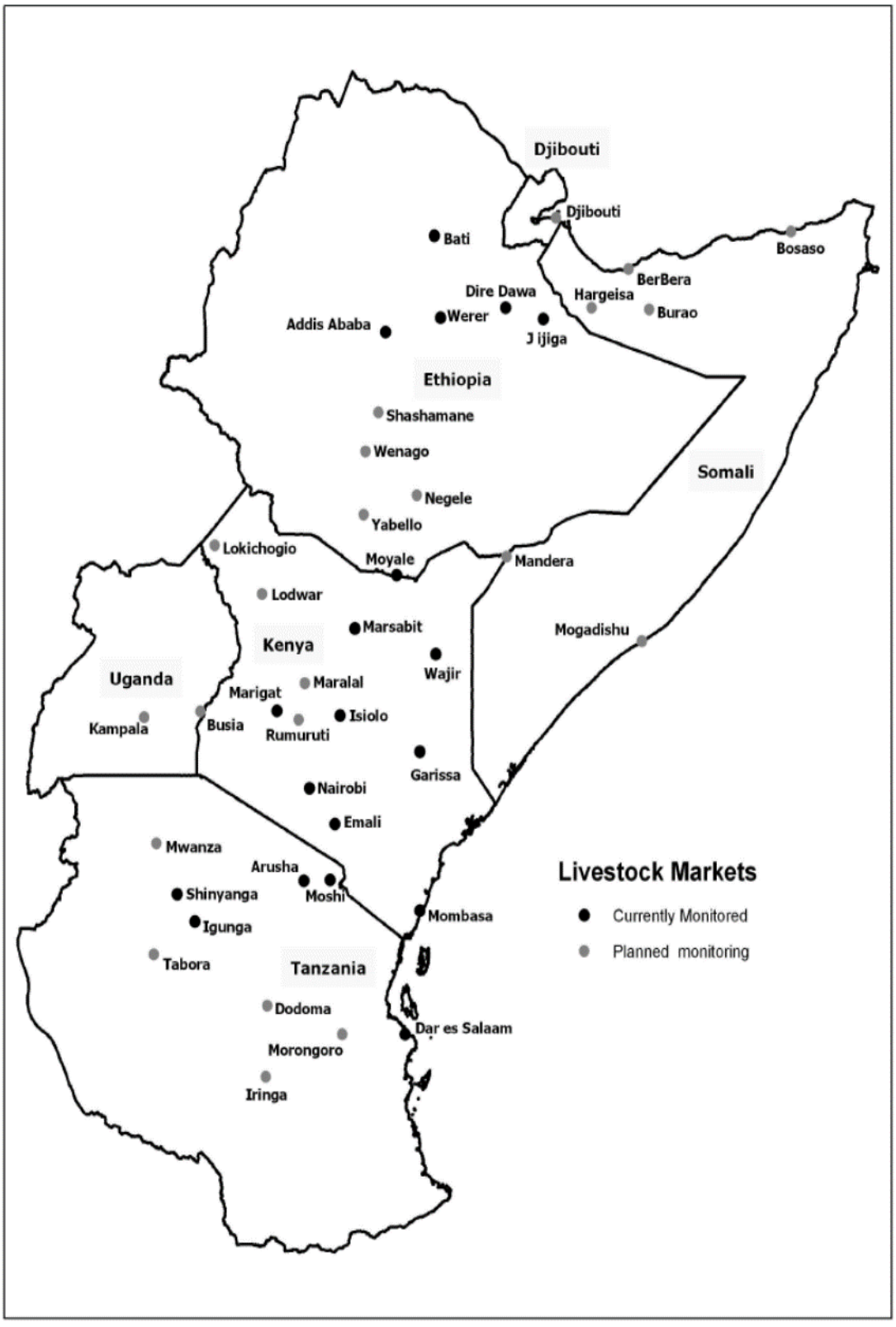


Figure 27: Livestock Markets Monitored in the early stage of LINKS – source GLCRSP, annual report 2005

6.4. LINKS: Roll-out process in Tanzania

The roll-out of LINKS in Tanzania was done simultaneously with other relevant changes to the civil service back in 2005/06, i.e. a top-down reform which reconverted some key ministries in Tanzania, among them the former Ministry of Agriculture, where LINKS would be initially settled. This set of institutional changes made the new LINKS project shift from one ministry to another. Some resources (human included) were also transferred to the new ministry.

Those transformations focused on key ministries; for instance, the Ministry of Livestock Development and Agriculture that became the Ministry of Agriculture Cooperatives and Food Security, and which would later be converted into the present Ministry of Livestock and Fishery Development, which is now the Ministry of Agriculture, Livestock and Fisheries (MALF).

To help me frame the roll-out process I had the cooperation of two actors involved in the process, at different stages of the process and in different institutions, and now working at the new ministry of Industry, Trade and Marketing. They are Mr. Chassama, economist, LINKS coordinator and main operator, and Mr. Manumbu, the Assistant Director of the Department of Marketing, Information and Research, the latter being a fundamental player in the implementation of LINKS in Tanzania. Both are still important actors within this ministry and in the livestock market structure.

Mr. Manumbu had previously been involved in the Marketing Development Bureau based in the Ministry of Livestock Development and Agriculture, where LINKS first appeared as a project under the leadership of the USAID Global Livestock Collaborative Research Support Program (GLCRSP), which brought the project to East Africa as I have pointed out earlier. According to Mr. Manumbu, LINKS:

> *"was a project aiming to replace one old service of livestock marketing system supported by the Symfony software within the Marketing Development Bureau, within the Ministry of Livestock Development and Agriculture".*
>
> **Interview#2 - Mr. Manumbu**

In 2005/06, as part of the civil service restructuring, Mr. Manumbu was transferred from the Ministry of Livestock Development and Agriculture to the Ministry of

Cooperatives and Marketing, which was then transformed into the Ministry of Industry, Trade and Marketing (MITM), where preparations were underway to set up LINKS. Robert Kaitho, from TAMU, Department of Rangeland Ecology and Management, the mentor of the project at the time, who helped to set up the system in Ethiopia and Kenya, would have the assistance of Mr. Manumbu and another worker within the Department of Marketing of the MITM to prepare and settle the service in Tanzania.

One of the key aspects to emphasize regarding the implementation process in Kenya, was the option to train livestock marketing officers in data collection processes, which allowed them to become LINKS monitors. This strategy was used as a base to build the sustainability and reliability of the system. Nevertheless, in the roll-out in Tanzania this was pointed out as vividly present but for opposite reasons. The lack of people trained to collect information made the system become fragile, mainly when the project changed from the Ministry of Agriculture (former Ministry of Livestock Development and Agriculture), where it was initially implemented, to the Ministry of Industry, Marketing and Trade where it is based presently. Mr. Manumbu, Assistant Director in the Department of Marketing, Information and Research in the Ministry of Industry, Marketing and Trade pointed out that:

> *"after Kaitho left we lost the track about who was responsible to manage the data, because Kaitho was able to track the data in the system. Now I don't know if they are doing that, and with Chassama[64] data can mean poor quality. It was easier with the Symfony[65] software, once after two weeks' data would still be there; the system was designed so in two weeks if you are interested you can have the data. So, you could rely in that system; you upload the data, you read, and you use it the way you want, and then you put the data back into the system, to where you can't see. Now two weeks and the data are gone, if you want data from two months ago you can't see them now; you can't get them now. These you can say are the challenges or present limitations of LINKS."*
>
> **Interview#2 - Mr. Manumbu**

Mr Manumbu's statement gave us a sense of some of the main challenges the service had and still has to overcome, and this painted a picture rather different from the information I found in some literature on the topic, and also clashes with interpretations from other actors within the same Ministry about the same issue, such

[64] Tanzania LINKS coordinator at the moment we did the data collection
[65] This was the system used to store data in the Ministry of Agriculture before LINKS was moved to the Ministry of Trade.

as the current coordinator of LINKS Tanzania, Mr John Chassama, who believe that indeed:

> *"[…] that is a challenge, because we as a Ministry of Industry and Trade we are not owning, or we do not have any mandate in that structure (Ministry of Livestock) and over the people who report to us (Livestock Market Officers), so we are just capitalizing that information (data sent regarding livestock trade). So, our demand [is not relevant…]. To ensure quality of the data … we depend on them (Ministry of Livestock).*
>
> **Interview#1 – John Chassama**

The above brought to the surface the existence of some tension between key actors and key Ministries, mainly when LINKS was shifted from the Ministry of Agriculture to the Ministry of Livestock when the former Ministry of Livestock Development and Agriculture were separated due to an administrative reform of the civil services; and later shifting a second time from the Ministry of Livestock to the Ministry of Industry, Marketing and Trade.

6.4.1. LINKS architecture and structure in Tanzania

The LINKS project was meant to be the interface connecting and allowing a huge range of actors participating in the livestock market to communicate in an efficient manner. LINKS was planned to be a mechanism through which collection, analysis and dissemination of information needed to help producers, intermediaries and traders, would be organized and systematized, providing near real time market information, which is available on request via SMS or internet.

The system was built upon a Global Systems Mobile communication (GSM) and Internet using, mainly, mobile phones to support communication and facilitating data collection and dissemination regarding livestock trade. This was meant to facilitate the interaction among actors within the livestock market structure and therefore enhance market efficiency.

In what concerns the architecture I can argue that LINKS was designed as a social system operating on a technical base, similarly to some tools and services that we are very familiar with, *known as social media* (Whitworth & Ahmad, 2014). The mobile phone (SMS) and the World Wide Web (WWW) being the technical base in this social

system which, according to Mr. Mareka, Network Engineer at the Computer Centre of the University of Dar es Salaam, where LINKS server is based, is supported by:

> *"two networks, the University network, and the one from the mobile communication, to where we are attached by a GSM, and with the GSM modem is where people send*[66] *and receive their response by SMS, while the URL*[67] *or the website, is within this network (University of Dar es Salaam) where you can access through the WWW."*
>
> **Interview#3 – Mr Mareka, Eng.**

6.4.1.1 World Wide Web (WWW)

The World Wide Web plays here an important role in helping to collect, organize and display livestock market information. The LINKS webpage is set up as a 2-way communication system where market monitors, who have access to this option, can enter data and receive reports on-line. The access to the livestock market information through the LINKS webpage is open to everybody but the on-line data entry component is conducted through a preapproved login ID, password and checking system for market monitors or data entry staff.

People involved in the design, implementation and maintenance of the system are aware of the importance of the internet, mainly regarding some of the societal changes brought about this resource, largely when there is evidence that the Internet is now more reliable in terms of access and speed. This is favouring LINKS and all the stakeholders relying on the service as pointed out by these people, and reasons are due to the fact that the Computer Centre of the University of Dar es Salaam, where the service server is installed, is now optical fibre based. This was made possible through the undersea fibre cable connecting East Africa to the Occident via Marseille, as suggested by Mr. Mareka:

> *"[…] whenever I try to trace where is my next hub, i.e. who is connected to me, or the near persons connected to me, my equipment shows that the device is in Marseille", [representing this as a significant change, not only for the livestock traders, but for thousands of Eastern African citizens relying on an effective Internet service]."*
>
> **Interview#3 – Mr Mareka, Eng.**

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[66] MK S MZAY MAGUHA 2009*5*15 C*TSZ*409 MM*38332000 MM*4*162000 (sample of a coded SMS from a market monitor)

[67] See LINKS webpage available at http://www.lmistz.net/Pages/Public/Home.aspx, accessed on 28/02/15

The above constitutes one major change that could eventually impact on the LINKS roll-out process, and that should be reinforced with the conclusion of the ICT backbone in Tanzania, which is part of a broad telecommunication strategy, as suggested by Lucas Mwalongo, Deputy Director of the Tanzania Communication Regulatory Authority., when referring to the National ICT Backbone (NICTBB):

> *"the NICTBB is the trunk road for the national ICT; it is joining even the neighbouring countries. We have three rings actually, the northern, central, southern and the eastern ring. Our national (structure) is fibre optical, it is fibre and it connects to the submarine cables. Initially we were only using the satellite, now we have the submarine cables and high capacity, so we can carry all the operators from the country and all the operators from the neighbouring countries, like Rwanda, Burundi, Zambia, Malawi that are connected to the national backbone, we also are connected with Kenya.*
>
> **Interview#51- Lucas Mwalongo**

This excerpt intimates that ICT services in future, and therefore both LINKS and livestock producers, are expected to benefit greatly from this new possibility. Nevertheless, and notwithstanding that both the WWW and the National ICT Backbone are important, evidence shows that LINKS is still relying more on the GSM national grid that supports the use of text messages over mobiles phones.

6.4.1.2 Mobile Phones and SMS

The SMS is one of the most common forms of communication among Tanzanians. This may be the reason why the SMS is a significant component of LINKS as the sociotechnical arena, and key actors in the policy arena are aware of changes that this has brought to the Tanzanian society in general and to the livestock sector in particular. Expectations are very positive about the potential growth of ICT services, which will greatly benefit LINKS, as pointed out by Lucas Mwalongo, an important player working at the regulation sector level:

> *"in general, we would say that this sector has grown very much in terms of technology, in terms of contribution to the GDP, in terms of products and services all has increased tremendously. We believe, because we are only having about 60% or 58% of tele density, so it means that there is a gap of about 40% to be covered, so we trust that it will keep on broadening, but not at the same speed it used to be before, because now almost all towns are covered, and from town this broadness is going to where the income is not the same as in town; i.e. villages [and therefore beneficiating the livestock keepers]."*
>
> **Interview#51- Lucas Mwalongo**

This prediction illustrates and justifies the efforts to carry a substantial amount of the LINKS traffic through GSM and using the SMS, which places the mobile phone at the centre of the sociotechnical arena. However, such changes bring new issues, for instance more training and education for ICT use among key stakeholders could help implement the change to a more institutionalised market relation, as envisaged by LINKS, and increase the pace of development. The market monitors have been "adequately trained in the use of livestock market data collection formats and given instruction and guidance on the proper ways of approaching sellers, brokers and traders to collect reliable data in an effective way."[68]

In architectural terms, and under the systems engineering point of view, the system runs upon a simple solution; it is constituted by a GSM modem attached to a server from where the data is loaded into the database. However, there is one particular limitation of the SMS technology as described by Mr. Mareka from the Computer Centre of the University of Dar es Salaam:

> "*it allows only 160 characters per single message whether it is between mobile phones or between computers and mobile phones."*
>
> **Interview#3 – Mr Mareka, Eng.**

As such the "LINKS project has designed a coding system for all of the key variables in livestock market data to cope with this limitation. The coded data is parsed out to automatically go into the central database." (Kariuki & Kaitho, 2006) as per the example provided in figure 28, which is 37 characters long:

[68] Brochure supporting the Livestock Market Monitors Training Session, Morogoro, Tanzania, May 2010, MITM, URT

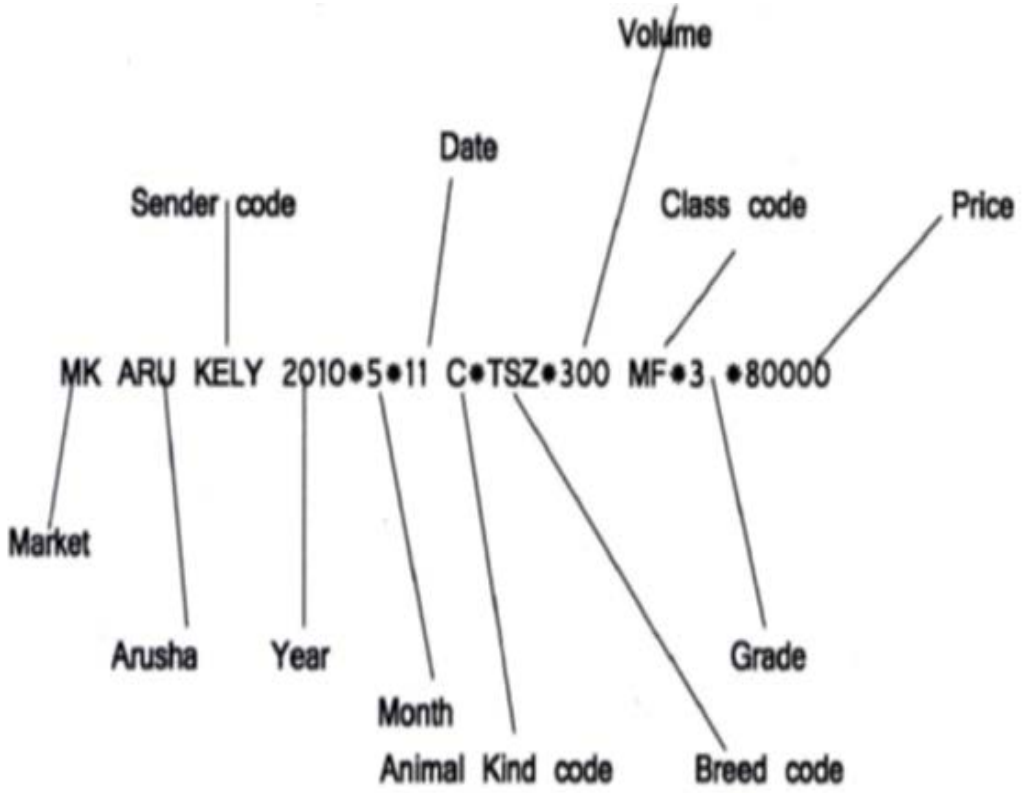


Figure 28: Coded SMS requesting information from a specific market

6.4.1.3 LINKS data production and analysis

The market monitors are relevant players in the data collection process, which explains why they were given training not only on aspects enabling them to deal with the mobile phone (*domesticating/appropriating*) to send/receive data, but also trained on adequate strategies to approach users, i.e. sellers, brokers and traders, to collect information regarding the market. This, with recourse to mobile phones, is expected to be done in a more organized and efficient manner. Reliable and timely data depends on the rapport and level of trust between the various market players. According to Mr. Chassama that is what the LINKS market monitors do when taking:

> "*the average prices after a simple calculation and after that the code. We have told them how to code, he codes the message in his mobile (phone), and after he codes the message he sends it to the server on that market day…some Monday, some Tuesday up to end of the week*".
>
> **Interview#1 – John Chassama**

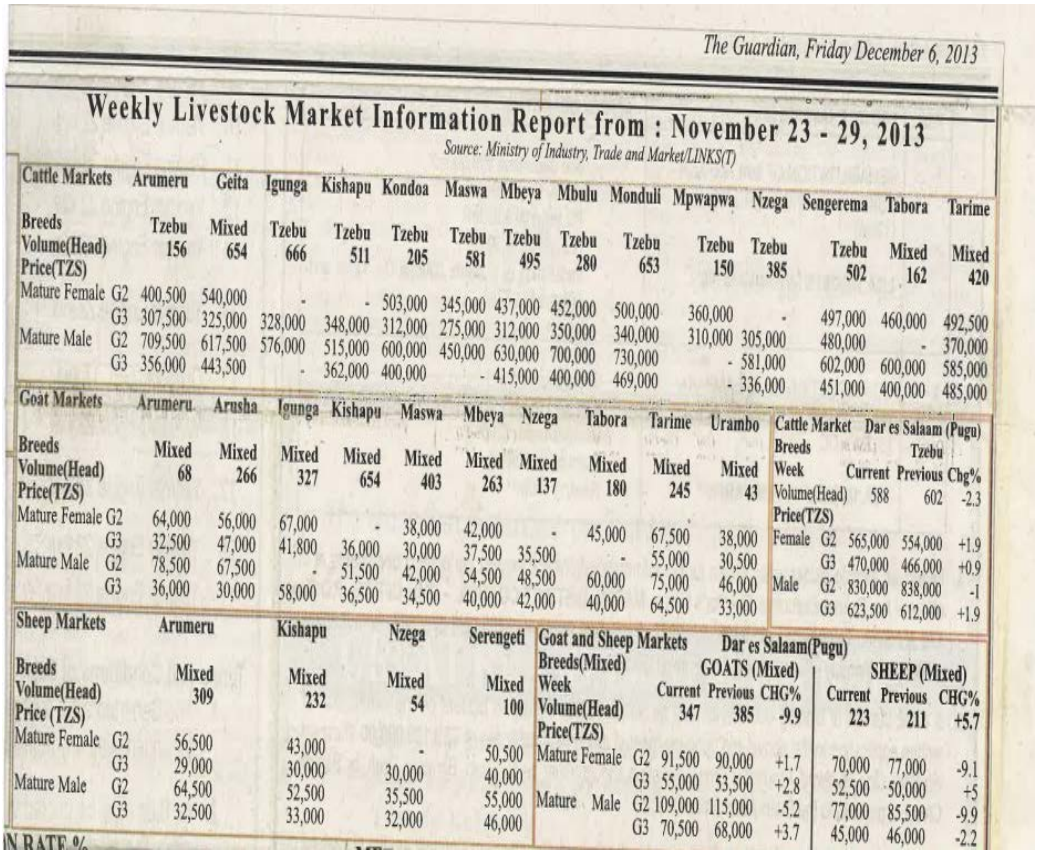
Information collected normally covers the selling price ranges (highest/lowest), animal of a particular class and kind (cattle, sheep, goats, and camel), per breed and grade. Based on this some estimates, mainly of the total volume of livestock arrived at the market, are then recorded. According to the LINKS coordinator, Mr Chassama, this is done when:

> *"they conclude their deal, they go to the market officer to shift ownership, then the LINKS market monitor is responsible to write some documents [informing] that someone sold some number of cattle to somebody for this price. So, the market monitor is the one who writes. Therefore, he uses that opportunity to blend the number, to blend the cattle, to take the total number of cattle sold or bought to that place. […] What we are reporting is not the number of cattle that enter that market, what we are reporting is number of cattle who was sold, who was traded in that market. So, all the cattle sold must be recorded by that supervisor, that is our market monitor and that is how the data is collected."*
>
> **Interview#1 – John Chassama**

Through this system, data is collected in the 53 markets integrating LINKS and sent to the server. Mr Chassama then retrieves the data from the server and executes the data analysis process as described:

> *"so, when I came to prepare the report, mostly on Friday, I enter the server and I collect the data on that week. I bring it and I start to do some simple analysis, like this now [showed me a datasheet], because when you enter the server is not like this. So, I enter in the server mostly on Fridays and I see the prices on that week and try to see if there are some outliers. [If yes] maybe I can call and say, "what happen to Arusha today" because today the price goes up. Maybe I can say, "there [are] people from somewhere that came and took all the cattle; or maybe there is some drought and most of the people release their cattle and there is a high supply and demand and the price go down. So, I can say 'that's is fine' if I see any outliers in the data that diverges from normal, so you can say that last week it was 300 000 and today maybe is 500 000."*
>
> **Interview#1 – John Chassama**

All this information is then loaded back into the server, prepared to be replied to any SMS received from a stakeholder. This is complemented with some traditional mass media, such as the newspaper, the most important used being The Guardian (English version, the Friday edition, e.g. figure 29 below), and some local radio.



The Guardian, Friday December 6, 2013

Weekly Livestock Market Information Report from : November 23 - 29, 2013

Source: Ministry of Industry, Trade and Market/LINKS(T)

Cattle Markets		Arumeru	Geita	Igunga	Kishapu	Kondoa	Maswa	Mbeya	Mbulu	Monduli	Mpwapwa	Nzega	Sengerema	Tabora	Tarime
Breeds		Tzebu	Mixed	Tzebu	Tzebu	Tzebu	Tzebu	Tzebu	Tzebu	Tzebu	Tzebu	Tzebu	Tzebu	Mixed	Mixed
Volume(Head)		156	654	666	511	205	581	495	280	653	150	385	502	162	420
Price(TZS)															
Mature Female	G2	400,500	540,000	-	-	503,000	345,000	437,000	452,000	500,000	360,000	-	497,000	460,000	492,500
	G3	307,500	325,000	328,000	348,000	312,000	275,000	312,000	350,000	340,000	310,000	305,000	480,000	-	370,000
Mature Male	G2	709,500	617,500	576,000	515,000	600,000	450,000	630,000	700,000	730,000	-	581,000	602,000	600,000	585,000
	G3	356,000	443,500	-	362,000	400,000	-	415,000	400,000	469,000	-	336,000	451,000	400,000	485,000

Goat Markets		Arumeru	Arusha	Igunga	Kishapu	Maswa	Mbeya	Nzega	Tabora	Tarime	Urambo
Breeds		Mixed	Mixed	Mixed	Mixed	Mixed	Mixed	Mixed	Mixed	Mixed	Mixed
Volume(Head)		68	266	327	654	403	263	137	180	245	43
Price(TZS)											
Mature Female	G2	64,000	56,000	67,000	-	38,000	42,000	-	45,000	67,500	38,000
	G3	32,500	47,000	41,800	36,000	30,000	37,500	35,500	-	55,000	30,500
Mature Male	G2	78,500	67,500	-	51,500	42,000	54,500	48,500	60,000	75,000	46,000
	G3	36,000	30,000	58,000	36,500	34,500	40,000	42,000	40,000	64,500	33,000

Cattle Market		Dar es Salaam (Pugu)		
Breeds		Tzebu		
Week		Current	Previous	Chg%
Volume(Head)		588	602	-2.3
Price(TZS)				
Female	G2	565,000	554,000	+1.9
	G3	470,000	466,000	+0.9
Male	G2	830,000	838,000	-1
	G3	623,500	612,000	+1.9

Sheep Markets		Arumeru	Kishapu	Nzega	Serengeti
Breeds		Mixed	Mixed	Mixed	Mixed
Volume(Head)		309	232	54	100
Price (TZS)					
Mature Female	G2	56,500	43,000	-	50,500
	G3	29,000	30,000	30,000	40,000
Mature Male	G2	64,500	52,500	35,500	55,000
	G3	32,500	33,000	32,000	46,000

Goat and Sheep Markets		Dar es Salaam(Pugu)					
Breeds(Mixed)		GOATS (Mixed)			SHEEP (Mixed)		
Week		Current	Previous	CHG%	Current	Previous	CHG%
Volume(Head)		347	385	-9.9	223	211	+5.7
Price(TZS)							
Mature Female	G2	91,500	90,000	+1.7	70,000	77,000	-9.1
	G3	55,000	53,500	+2.8	52,500	50,000	+5
Mature Male	G2	109,000	115,000	-5.2	77,000	85,500	-9.9
	G3	70,500	68,000	+3.7	45,000	46,000	-2.2

N RATE %

Figure 29: Disseminating LINKS information in local newspapers

6.4.1.4 Grading

The price of the animals sold within the 53 markets integrating LINKS still depends basically on a grading system that prioritises the aesthetic assessment of body condition (fatness) of a given breed as the main method to assess the animal, which will determine the grade and the trade price. This system is a compressed version of the body scoring system developed by Nicholson & Butterworth (1986) for zebu cattle, which is the indigenous breed. It is agreed almost unanimously amongst all players on the user side, that this system is more convenient, since there are no scales in the majority of the markets, and where they do exist they are not working due to lack of power or any other technical or social reason as I will point out in the empirical section.

For instance, Mr. Shasha, who is the Zoo Sanitary Inspector at Pugu market, says that:

> *"grading the animal, like this one, see this feature (showed me a picture), this is Tanzanian Bora, look this feature; these features is what implies grade 1, regardless the weigh, we are looking at their physical characteristic as portrayed in this picture."*

Interview#19 - Mr. Shasha

This is the voice of an important player acting at a technical level in what concerns livestock production. Those actors seemed aware of the importance of changing the assessment method, however they flagged up that the standard is achieved by some sort of social convention, where the tacit knowledge that is shared by the participants in the trade plays an important role. *Ipso facto est*, they have agreed that they will appreciate the physical characteristics of the animal and they will pull the tail to confirm the consistence of that animal; this has been a longstanding practice, and it seems unchallengeable, at least among the Maasai pastoralists as we will see later in chapter 7.

As such, the implementation of a common standard to assess and grade the animal, such as body weight, is one of the more recent attempts made by the policy makers to standardise the grading system, but it is not working. The ones responsible for implementing the policy have been confronted with the rejection of the hypothetical beneficiaries of that policy, and I was told that there are cases where the scales mysteriously appeared damaged after being installed. Mr. Shasha emphasizes that the traditional way of doing it is the most effective:

> *"they can just hold the tail of the animal and know how much the animal weighs".*

Interview#19 - Mr. Shasha

I will finish this point underlining that the aesthetical grading system is the approach used in the majority of the markets, if not all, taking part in LINKS chain, and it is supported on a scoring scale of 1 to 4 depending on the level of fatness of the animals (1: fat, 2: moderate, 3: thin, 4: emaciated). However, this practical and conventional way of assessing and grading the animal seems to serve one side of the market and not both sides, as would be desirable in a fair negotiation. For instance, Mr Manumbu says that this is something that is undermining the system and not favouring the formal procedure:

"the height is not captured, that is something that is affecting people, by the end of the day what we are interested in one animal by the weight, by KG, if I can't know how much the animal weighs and how much I am going to get, […] because I can't assess one animal just by looking. That is why the cattle mongers are doing a lot of cheating, you can go to the market and see how. That is why we started the grading system in Tanzania under the Symfony (the predecessor of LINKS), those markers which say breed and the weight of the animal would help them [keepers] to bargain. They would say "no, no, no let's weigh the animal and we have the average so we can calculate an animal of this weight of this grade will give a carcass of this kilo and so, so, and this will be 800 (thousand TSH) […], and we will know how much meat you are going to get and how much price you are going to get. So, they can say "you see this cow is of grade 2, its weight is 240kg, so I will get 120 (thousand TSH), so for this price I am going to get this, why are you offering me this kind price, what am I going to get?"

Interview#2 - Mr. Manumbu

Therefore, the assessment based on weight would naturally change the bargain process, but as I have said previously, and according to the majority of the respondents, it does not seem of interest to all with exception for some of the buyers interviewed which would appreciate to see a more rigours way of assessing the cattle be put in place. This is probably one of the reasons supporting the perspective of Mr. Aron Luziga, the Assistant Director of the Livestock Infrastructure, Development and Marketing at the MLFD, which has pointed out some deficiencies in the system, sustaining that:

"… up to now they manage to cover only 53 markets, and even in those 53 markets they are not managing well. We need to train more people that could collect data correctly, who can do the grading of the cattle correctly, who we can be active. You know, some markets are being conducted twice in a month, others twice in a week and some of them every day, and someone from those markets can send you the data without doing a particular grading and so on, and the information could not be correct or exact."

Interview#10 - Mr. Aron Luziga

6.5. Some reasons preventing LINKS uptake

In pointing out other reasons preventing LINKS from being more effective I will return to the market structure, and briefly characterize it. Presently there are over 400 primary, 12 secondary and 10 border livestock markets for cattle, sheep and goats that have been built over the years to facilitate the trade of livestock, and livestock products. They are complemented with several holding grounds, veterinary

checkpoints, dipping systems and slaughter facilities including seven modern abattoirs, which are supported by the LITA's (Livestock Training Agency) expertise, mainly in what concerns training, knowledge production and dissemination.

Regarding the quality of infrastructure of the markets, I observed that some of those markets are lacking investment, such as the main market in Maswa, or they need to be concluded, such as the cases of the new markets in Mwanza and Tinde. Those circumstances impinge challenges such as the best strategies to attract and facilitate private investment in different segments of the livestock sector in order to increase value addition, as advocated by Mr Aron Luziga, and spelled out in some of the official documents that were mentioned previously.

Improvement of the livestock market structure is one determinant step towards modernization, which is needed as communication strategy is developed. Both are critical, since they both facilitate marketing activities and processes. For instance, upgrading the market chain with key infrastructures such as scales and auction rings will make it possible for weighting, grading and auctioning to happen more frequently, and consequently to generate a more consensual assessment process, which will facilitate the process of setting up one national price for livestock. This, naturally, requires the architecture of the LINKS to be reshaped, because now, it is not working, as pointed by Mr Manumbu:

> *"… those that are there in the bush if you talk to them about LINKS they don't even understand what it means; those individuals they are going to the nearest markets, the primary livestock markets, they sell their animals there and the traders take them to another market until they get to the terminal market. LINKS is not affecting [them], simply it is not there, in practice it is not in the ground."*
>
> **Interview#2 - Mr. Manumbu**

The above quote mirrors substantially the opinion of a large number of actors, from both sides, e.g. policymaking and producers, and substantiates that LINKS is not working. It is time to observe the producers' behaviour and as suggested by Mr Manumbu *"to revamp"* LINKS and set up a new communication strategy to promote LINKS amongst its main users, since it is proven that the mobile phones are already a fundamental tool and changing the way the livestock keepers interact with the livestock market.

As illustrated during this last section, there are many constraints generating impasse in the uptake of LINKS. Factors such as the tacit and practical knowledge that are deeply embedded among the key actors and participants in the livestock trade, which are apparently extremely difficult to disembody, are the main source of constraint in the attempt to implement a more institutionalised market relations and associated regulations. Thus, sensitivity is required when approaching key actors and participants, mainly because the constraint varies from region to region, and these are some of the strongest reason why LINKS is not operating as expected.

In parallel, there is a lack of knowledge of the service existence and functionalities, which is aggravated by the lack of technical infrastructures to support adequate operability of the mobile communication services. Therefore, some key actors involved in the trade are exposed to market fragilities and other sources of constraint, as we will illustrate next using data from Arusha and the Lake Zone concerning livestock production and marketing. Additional information was collected from key players acting inside the Ministry of Industry, Trade and Marketing, where LINKS is based and therefore being managed, and the former Ministry of Livestock and Fisheries Development (MLFD). Concerning LINKS, and according to Mr. Chassama (LINKS coordinator) the system is presently covering "*53 markets*[69]*, and from them 22 are secondary markets, and 31 primary markets*" providing information on live animal trade. Those 53 markets represent approximately 13% of the total livestock markets existing in Tanzania (400 markets), which, according to Mr. Aron Luziga, is relatively low and poor quality of data collected. He pointed out that:

> *"ICTs have a big role to play actually, and it is not quite well developed in this field; […] we need to train more people that could collect data correctly, who can do the grading of the cattle correctly, who can be active […]. So, if you want for example to create a competitive market, if you want the abattoirs to work, the ICTs can really help, because they can link the livestock producers to other people."*
>
> **Interview10 - Mr. Aron Luziga**

The above indictment, coming from a key actor, points out an important factor preventing uptake of LINKS (more training of people to collect reliable data), which is hindering the service from being perceived as a credible option. This gives the

[69] As I have said in chapter 5 there was a total of 400 livestock markets during the period of data collection. I don't have any information that this figure has changed.

opportunity to question the strategy used by the Tanzanian government to implement the change – similar to a top-down perspective of policy implementation – and to argue that in the LINKS case this approach is not working, which gives further reasons to ask, if the policy makers, implementers and managers are aware of this inefficiency (as per above quote), why they do not take effective action?

As verified earlier in this chapter, there are various factors and variables that are contributing to this inefficiency; for instance the demand and the pressing need for cattle products; the lack of training for the users in what concerns the ways of utilising the resource adequately; and the lack of, or poor, telecommunication infrastructure prevailing throughout the country – which in practical terms increases the delay for response to a SMS requesting livestock marketing information. These factors make it hard for the system to be efficient, and also, probably the most relevant cause of the manifest disinterest of the producers in using the system.

Those factors are perceived by some of the main actors as critical reasons why the Livestock Development Programme (LSDP) prescribes a well-coordinated system of data collection and management dissemination, and availability of trained technical staff in data analysis as the solution to implement the desired shifts in the livestock market. However, and due to the set of reasons we have pointed out earlier in this chapter, we can claim that producers do not use the system because they believe that the system will not favour their business. Some other reasons were advocated in a critical analysis done by Mr. Manumbu, who has been involved in the implementation process from a very early stage. He notes a set of reasons for this hypothetical failure, suggesting that:

> *"… livestock keepers and traders don't know how to require information from that system, as far as the price is concerned. This is where I think we still need some intervention, some knowledge about the system. Even within the department there are people that do not know how the system works and what LINKS is, and that is a problem, [and] "due to lack of human resources. If you have just one guy, you cannot manage it! That's why the livestock men they don't even rely on this information …,] the ones doing difficult decisions every day, where to take the cattle or not to take the cattle – because there are Fridays in Dar es Salaam – and that information needs to flow, and the system is not providing it."*
>
> **Interview#2 - Mr. Manumbu**

Amongst the users interviewed, on average only a residual number (3%) were able to identify LINKS as a service that could provide them with critical information

regarding livestock marketing and help them to create conditions for the decision-making process. In section 9.2.1. I will develop a Decision-Making Diagram, which aims to illustrate the two optional paths that producers can choose to search for critical information regarding daily livestock prices and explore my argument further.

Mobile technology is at the centre of this transformation and the *domestication/appropriation* (Sørensen, 1996b, p. 10; Williams et al., 2005, p. 7) process is increasing the possibility to tackle chronic issues constraining the sector and in some circumstances allowing changes to happen among some social groups. This new mobile based phenomenon is now regularly used in the informal side of the livestock market and is making LINKS less relevant than planned by policy makers.

Pastoralists and agro-pastoralists when *appropriating* the mobile phone, they use it to search for information regarding the livestock market in the informal network. This leads to the generation of a new agency (power to bargain), which can be perceived as an unintended consequence of the appropriation of mobile phones. In turn, this is indirectly beginning to improve conditions for LINKS to take off. I will further this discussion during chapter 9.

However, the above evidence needs to be interpreted and used by policy makers adequately as they constitute positive inputs to revamp the system, mainly because evidence has shown that the use of the mobile phone and the new way to approach the livestock market is generating new possibilities and new agency for those producers, as this is contributing to them being able to disrupt some of the rules (trade relations with other agents within the livestock market), which was one of LINKS initial goals.

The lack of information to support producers' decisions or to give them tools to trade more efficiently is one reason given by participants in this research as preventing the livestock sector from performing as expected, mainly when taking into account the potential of this sector, as pointed out by the Assistant Director of Livestock Infrastructure, Development and Marketing:

> *"You know we are the second in all Africa in numbers of livestock, but sadly we are the ones getting less from the sector, but with this transformation, [improvement of LINKS], maybe with the contribution of livestock we can be the second or third in Africa. There are small countries, like Botswana, that have a good number of livestock and their economy are really making difference based on the contribution of the livestock sector; Botswana, Namibia, South Africa, Zimbabwe because they have already transformed*

the sector in terms of technology, in terms of processing and addition value for their livestock and so on, [and consequently they are performing well]".

Interview #10 - Aron Luziga, Assistant Director

Another set of factors, such as the lack of infrastructure and the prevalence of some diseases such as the infestations of tsetse and tick-borne diseases, have been suggested as complementary factors negatively influencing the sector and contributing to this postponement. Another reason given is the suggestion that producers' behaviour, mainly the Maasai pastoralists, is a negative factor, since their behaviour is frequently indicated as one important constraint. The reason is said to be that Maasai producers largely favour high stocking densities, which causes detriment to the quality.

These 'chronic' reasons preventing the Tanzanian government strategy from being successful, are expressed in two documents[70] which prescribe the need to enhance the productivity of the livestock sector, and therefore promote a shift from an extensive to intensive modus of production. This should allow a move from a more subsistence level perspective to a more market-oriented strategy, supported through the dissemination of the livestock marketing information.

This policy was expected to help revitalize the sector and create conditions to achieve the goals set out in the National Strategy for Growth and Reduction of Poverty (NSGRP), popularly known as MKUKUTA, which supports those views and strategies, which includes marketing, information and knowledge dissemination as an important component. Those documents are consistent with some other important strategic documents, such as the Agricultural Sector Development Programme (ASDP), which goal is to:

"Raise sectoral GDP from TZS 9,600 billion (USD 6.4 billion) in 2010/11 to around TZS 30,600 billion (USD 20.4 billion) in 2030/31. GDP per capita among the rural population would increase from around USD 180 to USD 360 over the same period."[71]

[70] That strategy was made available through two key policy documents: The Livestock Sector Development Strategy and the Livestock Sector Development Programme

[71] Agricultural Sector Development Programme II (ASDP II, The United Republic of Tanzania, August 2017)
http://www.kilimo.go.tz/publications/english%20docs/ASDP%20FINAL%2025%2005%2006%20%282%29.pdf, accessed on 19/02/15

Those goals pushed the former MLFD to implement significant changes in the livestock policy and to promote relevant alterations in the livestock market infrastructure, but, according to Mr. Aron Luziga, there is still more to be done:

> *"Our vision now is to help the industry to value addition. You know the livestock production chain is not complete; there are the producers, there are 22.8 millions of cattle, there 17.2 millions of goats and the are 7.5 millions of sheep, the producers, farmers and also the pastoralists are producing, they are having the markets, which are helping us to create a strong domestic market, but now we have reached the place that the number of the livestock are creating chaos in the country, there are a lots of tension between farmers and the livestock keepers (pastoralists), between the national parks and the pastoralists and so on. The numbers are multiplying, and we do not have a place to sell the livestock. So, the biggest transformation which we are now trying to implement is a big campaign to invite investors to come into the country to put on some slaughter house, some abattoirs, which can buy livestock for a good price from those pastoralists and process the products and export to middle east or within Africa, for example Angola, Zambia, Congo DRC or central Africa, where the demand for meat is high. So, what we are expecting now is to complete, or to link, the chain. The abattoirs will have a programme to encourage livestock keepers to produce according to the market needs; to produce market breading so they can be able to help then to cope with their livestock and so on […], because now if you go to Arusha one Maasai could have 300 heads at one time and still poor, and when sending the cattle to market only 10% of the cattle will be sold.*
>
> **Interview #10 - Aron Luziga, Assistant Director**

The reasons determining why just a small proportion of the cattle sent to market will be sold can be of different order. The most common is the price offered per head, which sometimes does not satisfy the producer, mainly if it is a Maasai, who will never sell below the estimate of the Laiboni (please see section 7.2.2.). They prefer to take animals back home rather than to sell for a low price.

As noted earlier, the physical condition of the cattle when they arrive at the market is very important, as it will allow the aesthetic assessment to play in favour or against producers. Trekking, which is the main way of taking the cattle to market, has negative implications for the cattle's condition because it can make the cattle lose condition easily, and make the bargaining process fluctuate in favour of the buyer. This brings uncertainty to the market, and it is known that uncertainty brings negative expectations, which in the majority of circumstances plays against the producer.

Government strategy to disseminate the cattle price through the sociotechnical arena (LINKS), aims to influence the dynamics of the market by making more information available and therefore decrease uncertainty. We can point out 7 relevant documents

where this strategy is written, these the Agricultural Sector Development Strategy (2001 and 2017), the Agricultural Sector Development Programme (2006 and 2017), the National Livestock Policy (2006), the Livestock Sector Development Strategy (2010), the Livestock Sector Development Programme (2011), which needs to align within the Agricultural Sector Leading Ministries (ASLMs) macro strategy designated as Sector Wide Approach (SWPa).

The Ministry of Agriculture Livestock and Fisheries (MALF) is a crucial actor in development of government policy, therefore its strategic goals, expressed in the LSDS (2010) and the LSDP (2011), are a major part of the ASLMs strategies and programmes. The strategy and instruments to implement the change exist therefore. However, there is a need to implement those strategy documents.

Chapter 7 – Livestock production in two key regions of Tanzania: perspectives from the Arusha region and the Lake Zone

7.1. Introduction

This chapter describes livestock production in two key regions of Tanzania: Arusha and Lake Zone. Sections 7.2. and 7.3. will contrast those two regions. In those sections, I will be looking at two dimensions: production and marketing and exploring the appropriation of mobiles phone in different ways and for different purposes, seeking to illustrate how this is affecting processes, tasks and behaviours amongst key players and, most importantly, how the integration of that device is helping those actors to self-righting and becoming more resilient. In section 7.2. I will discuss livestock production in Arusha, pointing out the exigencies of pastoral herd management and strategies to manage these challenges in Arusha region (7.2.1.), and then introducing some of the market dynamics (7.2.2.) and strategies (7.2.3.) that help to tackle the duality price/distance. In section 7.3., I will present the production strategies used by the Wasukuma people in the Lake Zone, pointing to the risk factors and strategies (7.3.1.) and market dynamics (7.3.2.) in that region. Section 7.4. will proceed with the concluding remarks.

With recourse to the FAO classification of the world's Livestock Systems and Agriculture Production Systems I shall attempt the characterization of both regions being compared. The FAO agricultural classification will be used as a reference, because it is directly applied to the main sector (Agriculture) in which livestock will emerge as a sub-sector. However, in doing this characterization it is relevant to say that the INTENSIVE SYSTEM will not be included because, due to a multiplicity of factors, mainly socioeconomics, this system is not a real option in the Tanzanian context. Only a small number of producers use this production system, known as the national ranching companies (NARCO), which operates under the supervision of the government. In what concerns the prevailing systems of production in those two regions, it is possible to say that Arusha is more extensive based and supported in pastoralism, and the Lake Zone more semi-intensive and relying in agro-pastoralism.

THREE MAJOR AGRICULTURAL SYSTEMS OF PRODUCTION

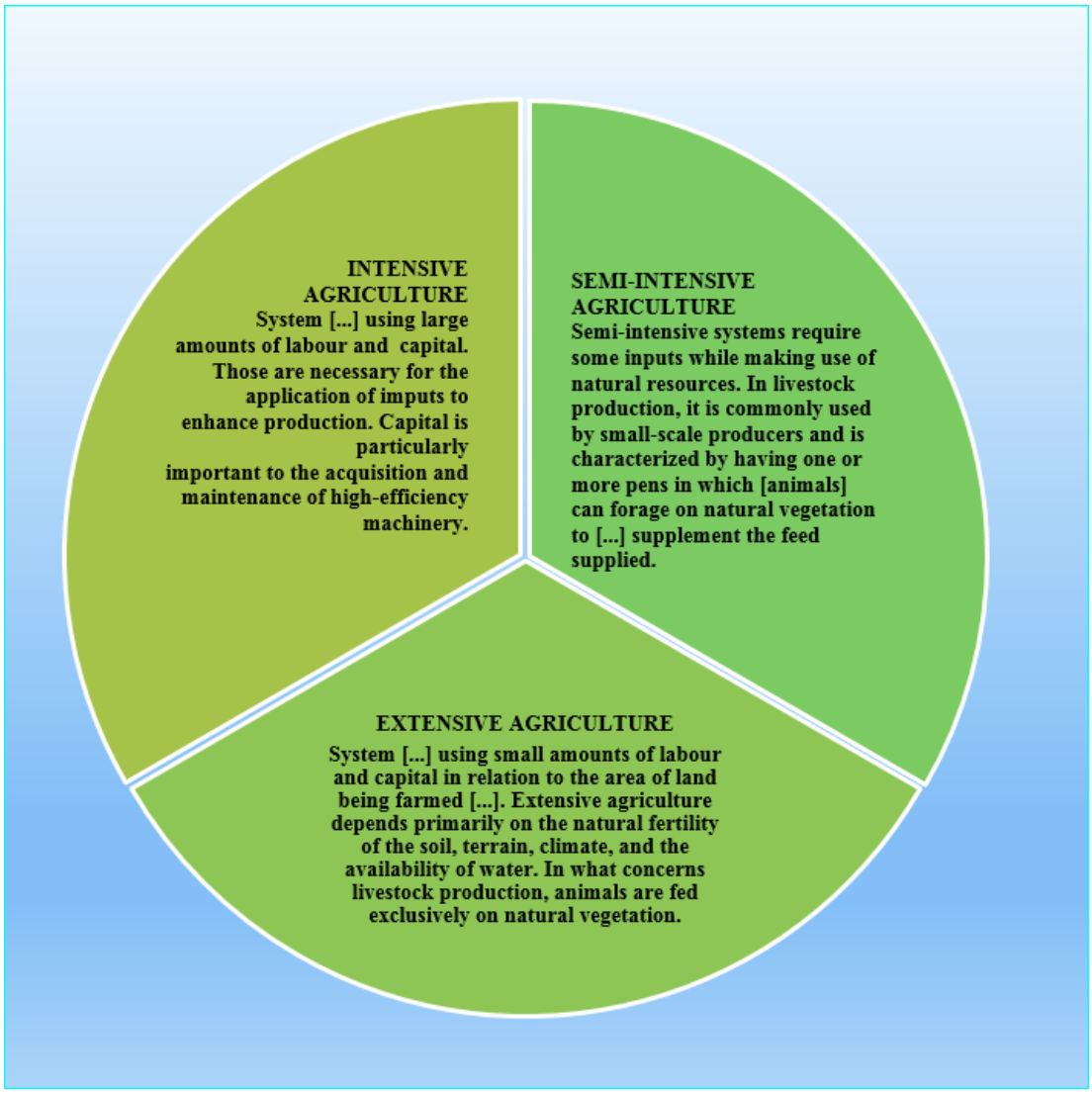


Figure 30 - Source Food and Agriculture Organisation of the United Nations

7.2. Livestock production in Arusha: the Maasai pastoralist traditional lifestyle

I now centre on Arusha and characterise both the producer and the production systems and what their involvement in the co-construction or sociotechnical transformation of the livestock market is. In starting with Arusha, I will need to place the Maasai people and pastoralism at the centre of the narrative. As such, when introducing them I need to try answer some relevant questions, mainly what problems do they face? As noted in Chapter 3, Arusha region is constituted by 7 districts: Arusha City Council, Arusha District Council, Karatu, Longido, Meru (or Arumeru), Monduli and Ngorongoro.

During the fieldwork 3 (Ngorongoro, Sale and Monduli) of those 7 districts were visited and data were collected in 2 divisions of Ngorongoro district (Loliondo and Sale) and in Monduli town. Across this region, I had the opportunity to conduct ethnographic fieldwork, using observation and semi-structured interviews as one of my methods of data collection. Fieldwork took me to three markets in this region: Waso (Loliondo), Malambo (Sale) and Mesarani (Monduli).

7.2.1. Exigencies of pastoral herd management and strategies to manage these challenges in Arusha region

I will start by characterizing the livestock production from the Arusha perspective. Concerning the prevalent production system, I can point to pastoralism as being the dominant system, being part of the culture of the tribe inhabiting this region: the Maasai. I shall discuss dilemmas faced by Maasai pastoralists when managing their herds, underlining which are the factors that are influencing the management of the herd and which are the strategies used to overcome those constraints. Amongst the factors restraining pastoralists' activities, access to land and perceptions about weather changes emerge as critical since they are synonymous with access to pastures and nutrients for the herds. Land issues are on the top of the agenda of all participants in the livestock sector in this region, from producers to policy makers.

For instance, restrictions on moving the herd freely from one area to another brings constraints for production and herd management strategies, since it decreases opportunities to access grass and water. However, as noted already, due to the environmental crisis and to political and economic factors, the access to this resource is becoming increasingly more difficult and generating what some informants suggested, using a metaphor, that the *'land is shrinking'* and increasing difficulties in accessing the best grasslands.

Those adverse factors are dictating new directions and advising the need to find production alternatives, which are becoming more prominent. Observation in both districts provided a sense of the issue and the chance to identify one trend: as a rule, there are large herds of cattle in Arusha region. This is assumed as a strategy associated

with risk management, as suggest in the resilience literature, i.e. pastoralists need to have more in order to cope with unexpected losses, and this sat side by side with some socio-economic and cultural factors, which I will now explain and describe.

The freedom to move under the custom of communal access to land, that used to be one key aspect of the Maasai society, was changed due to recurrent changes in weather patterns and political decisions. This is generating new production dynamics in local practice. For instance, according to Timothy Oleyaile, the Women Pastoralist Council (WPC) programme coordinator in Longido, and also a pastoralist, these movements used to be a common practice among the Maasai, and they used to take animals north and from the north to the south according to the rainy season, without any sorts of constraints:

> *"[…] something that we always have done; presently is critical because the 'land is shrinking' forcing us to move permanently in order to find good pastures and water to feed the herd."*
>
> **Interview with Timothy Oleyaile**

All interviewees to whom I asked the question about freedom of movement answered affirmatively and pointed this out as critical: the need to be able to take cattle where there is grass is key. Opposition to this freedom to move the cattle is confined exclusively to the side of technical-bureaucratic actors. This is a sensitive issue because the restrictions are forcing Maasai pastoralists to go even further in search of the best pastures. This need to walk more and to go further emerges as counter-productive as it makes the animals lose condition and, at the same time, exposes pastoralists to other negative consequences such as to face thieves and/or facing military forces. This naturally is affecting production trends and consequently increasing the vulnerability to poverty, mainly because the:

> *"main source of earning is by buying and selling cattle, we don't have other place where to get a salary, so [production] depends on the [socio-political] conditions on a particular area."*
>
> **Interview#50 - Saringe Rago, Laiboni of Maaloni Village – Waso**

The unpredictability of rainfall emerges as another variable and risk factor influencing production and forcing the pastoralists to reformulate their strategies, such as moving the cattle from one region to another during moments of the production cycle when it

is not supposed to happen. In some circumstances, mainly when the lack of rain is pronounced and generating severe droughts, pastoralists are pushed to search for new options or new activities to overcome the lack of opportunities and the insecurity triggered by weather changes. Several pastoralists who decided to change their activity after experiencing the consequences of a severe drought pointed this to me. Mr Mollel (Maasai trader) words are illustrative of this option:

> *"That time I was already a keeper and a broker, I was conducting both activities, and after having a big loss (due to drought) I decided just to be a broker."*
>
> **Interview#54 - Mr Mollel - Maasai trader - Mesarani MKT**

This forces us to acknowledge that it is difficult to discuss constraints affecting pastoralism without mentioning that awareness regarding weather change is an important aspect of the debate, which frequently determines an equation of which the perception regarding the result is most of the time negative:

$$[(> Rain) + (< drought) = (> pastures)]$$

This aspect was emphasized by several keepers interviewed in this region, and underlined by the above pastoralist who was forced to become a trader in the sequence of negative events generated by "the East Coast Fever in 1998 and then the drought 1998-2000" (Hodgson, 2011, p. 198) which make:

> *"… livestock keeping [being not] a reliable activity; you know when the drought comes you can lose everything, and by just trading the losses are less."*
>
> **Interview#54 - Mr Mollel - Maasai trader - Mesarani MKT**

As such, it is now more frequent to find middlemen whose former activity was livestock production. For instance, during the time I spent in Arusha I had the chance to hear and to witness similar stories to the above, where pastoralists after facing dramatic situations triggered by weather changes and diseases outbreak managed to bounce back and regenerate their livelihoods, opting for different activities, the most frequent option being to settle on an activity and livelihood in a regime of agro-pastoralism or becoming involved "in the expanding tanzanite mining industry" (Hodgson, 2011, p. 196). But the reality is far more dramatic than that; there are thousands of livestock keepers struggling due to severe droughts and increased

difficulty in moving, and a significant number of them are facing the risk of being thrown into famine as a consequence of the low quality of the herds.

This is one of the most visible faces of Arusha region, and as pointed out by Mr. Aron Luziga, when emphasizing that notwithstanding the high stock density approach, it is quite frequent to find producers owning large herds and still remaining poor. I underline that this is the most visible factor affecting those pastoralists' lifestyle, which has increased the competition for land and inherent resources, aggravating tensions and disputes, and intensifying old and unresolved rivalries, which are now more frequent and generating new social phenomena such as wars among clans that in the recent past used to have good neighbourly relationships. For instance, it is now frequent to hear that the Maasai and Sonjo are fighting for the land, as explained to me by the Ngorongoro District Veterinary Officer, Choby Clement Chuba:

> *"Sonjo are occupying a very small percentage of land in Ngorongoro, and the Maasai they are occupying a very, very big land in Ngorongoro and they are more of pastoralists. They have temporary houses, so they are shifting more from one place to another looking for pastures. Actually, the big population of animals are owned by Maasai and not the Sonjo, which is occupying a very little small area; but, in that small area, where they are, there are a good number of rivers, the source of water. Actually, it tends to be more fertile when comparing with other areas, so they used to fight the borders, the Maasai and the Sonjo."*
>
> **Interview#56 - Choby Clemente Chuba**

If we look back at the history of the region, we find that tension and clashes were part of the existence of those two tribes. However, and after a large period of peace, they are now intensified by the '*shrinking land*' phenomenon, which has increased the competition for natural resources, and has given new dimensions to those old matters. Nevertheless, there are positive lessons to be taken from those constraints. For instance, they have built in both tribes the awareness of a need for sustainable use of those resources, mainly the Sonjo. Still, the harsh conditions of this region and the lack of rain keeps on increasing the need to find alternatives to graze, which is now pushing these people to graze in areas where it is not permitted:

> *"They have been limited to shift the cattle within the demarcate areas (corridors) or within the areas known as belonging to them, unlike they go graze within the national parks, they go and graze in farms areas, where farmers have their cattle,"*
>
> **Interview #10 - Aron Luziga, Assistant director**

Currently there is the idea that the Maasai pastoralists keep too many cattle for the land, and it is suggested that this high-density stock approach is a factor contributing to, or enhancing, the environmental crisis. It is said that there have been some attempts to raise awareness among the Maasai and induce them to reduce the size of their herds as one best practice to increase productivity. However, this is a sensitive issue for any Maasai, because the size of the herd is not only linked to livestock trade but as well as with direct goods generated by those assets (milk, meat and blood), but more importantly is symbolically associated with prestige and social status resulting from herd size. However, the size of the herd entangles many challenges and one of them is the risk attached to recurrent livestock market fluctuation, which affects most those producers who relying just on cattle as their main asset. This contrasts with production strategies undertaken in the Lake Zone, as we will see, where producers are practising agro-pastoralism, and spread their capital and investment across more than one asset (cotton, maize and livestock), which gives them more chance to cope with the livestock market fluctuations.

7.2.1.1. Pastoralists' social status and correlation with herd size

One of the most visible aspects of livestock production in Arusha is that keepers[72] (Maasai pastoralists) traditionally choose to have large herds (suggested by literature as the high-density stock approach) in detriment of the quality (a low-density approach) typical in other regions. Based on information collected among those producers and from observation done, it is possible to suggest that the high-density approach is a common practice in the Maasai community, where some strong cultural and religious beliefs play a significant role in preventing them from massively harvesting the herd. As pointed out by some of my interviewees, the social status

[72] As said in section 3.1. there is a set of roles and tasks attached to each of the age sets in the social structure of the Maasai. Frequently among the keepers there are many children (*Layko*: uncircumcised boy) taking care of the herd, which is part of a long process of preparation for the *manhood* or *warriorhood* age. However, the age set to which the task of keeping the herd is attached is the one corresponding to *Morani (*early years of the *adulthood* age*) and the junior elder agehood.* Among the Morani age set just a few of them will have the chance to become a warrior, and the ones less apt to develop this role will, during their active years, take care of the large herds which will cross a period of approximately 14 to 15 years. This fact is also relevant in what concerns the right to choose a wife and to get married. The order is first the *Morani* who has completed his service as warrior up to seven years and graduated to a senior warrior and then the *Morani* who has achieved the junior elder agehood and is economically capable of taking care of the family, the same is saying that one is owning more cattle.

emerging from having a large herd is one of the factors, probably the most important one, justifying the high-stock density approach, because status in the Maasai society is acquired mainly according to the number of animals that one possesses. For instance, if one wants to get married then the herd size plays a great role in that process; or if one wants to be eligible for a given position within the Maasai social structure (i.e. to be an *Olaigwanani*) then age and the size of the herd are two key factors - the bigger the better. The size of the herd is fundamental, not only to manage risk, but to acquire status within the community, hence the aspiration of any Maasai man to have a large herd, as illustrated in this dialogue:

R/Q – how many head of cattle you have now?

P1/A – 50

R/Q – and you?

P2/A – 200, but I want to make sure that I will have 1000.

Interview#5 - Philémon Olé Saipi and Masige Shomi (pastoralist/middlemen)

Large herds help to make a difference within the social structure, reasons why they prefer to rely on big herds and cannot afford to lose one single animal, as pointed by Timothy Oleyaile, the WPC programme coordinator in Longido, who aspires one day to become an *Olaigwanani* in his village. He states: "*I just have 100*[73] *heads, I cannot afford to lose any animal*" when recounting a story where he almost lost 10 cattle as we will see later in the next chapter. As such, herd size is very relevant for this people, not only to manage risk but also mainly to achieve recognition and social status, but this has the reverse side, since it will increase the difficulty of managing the herd in a sustainable manner.

Let us now talk about the *Laiboni*. In chapter 3 I described the Maasai social structure; there I described the *Laiboni* as the spiritual leader of the community and as being on the top of the social stratus. Therefore, it is of no surprise that any *Laiboni* will have plenty of cattle, and consequently many wives, and many children, and if boys all the better, because they will help to take care of the large herds during the *Layko* age hood. This fact was brought to my attention by a member of the *Pamoja Tuwalee*[74]

[73] This is a threshold which defines the line between being poor or rich
[74] *Together Let Us Bring Up*, in English

delegation during a visit to Maaloni village in Loliondo, Ngorongoro district, where they were conducting a sort of census of orphans and children with needs in that village, and I was invited to take part in the delegation. Members of the *Pamoja Tuwalee* suggested that those phenomena were a sort of collateral effect of the high-density stock approach, which is claimed to serve two purposes: risk management and cultural practices. This is pointed out by some members of that organisation as a factor generating significant issues in the familial and social structure, such as the increase in monoparental families or the incremental number of Maasai children not going to school, and not having medical checks, and care if needed, because they are busy taking care of large herds. During this visit, I met Saringe Rago, the *Laiboni* of that village who agreed to be interviewed the following day. The *Laiboni* confirmed previous information about the reality of the high-density stock approach, as this short dialogue illustrates:

"R/Q - are you also a livestock keeper, do you have your own cattle, and do you trade?

P/A – Yes, I have, and I trade.

R/Q - how many head of cattle do you have now?

P/A - 500 cows, 500 sheep and 150 goats.

Interview#50 - Saringe Rago

This not only confirms previous information but also reaffirms that amongst the Maasai people social status is inherent in the number of cattle that one holds, and this is a key aspect of the culture of this people. However, this preference for large herds encompasses several problems, like those I just point out, and others such as the over-use of natural resources and the increased risk of having to manage loss when facing droughts or floods. The high-density stock approach emerges as the most outstanding aspect of the livestock production is this region, because the majority of the keepers were not able, or inclined, to embrace official recommendations to reduce their herds, opting rather to take their *Laiboni* as the role model, and own large herds.

Notwithstanding this firmly grounded cultural practice, nowadays there are some pastoralists acknowledging that there are other strategies that can be put in place to better manage the herd. For instance, it is possible to opt to have less but to increase the size when the grass is plentiful, or to have a large herd but to harvest it more

frequently and reinvest, setting up a new cycle of production. However, it seems that there are:

> *"some pastoralists that seem not to understand the consequences of selling the cattle during the periods that the price is low, because when there is a crisis they say that there is no other way of getting money, and they destroy the price because of the problem."*
>
> **Interview#50 - Saringe Rago**

Surprisingly, it was the Laiboni of Maaloni village itself who brought this issue to my attention, emphasizing the importance of the rain for settling a more sustainable production strategy:

> *"During the raining season, there is more grass for grazing, so the animals are looking good, they have good weight and we can sell for better prices […]."*
>
> **Interview#50 - Saringe Rago**

This view coincides with other sources, mainly the District Veterinary Officer in Ngorongoro region, where I obtained confirmation that this is a common practice amongst the Maasai. They traditionally opt to have many animals and only a good rainy season will push them to harvest the herd because some animals will look very good and they can sell just a few and obtain a good price, mainly when approaching Nairobi markets, as described later concerning the issue of cross border trade.

However, a good rainy season is no longer the climatic pattern in this region: the tendency is to have more frequent years of drought than in the past. This is generating a paradox with traditional practices, forcing pastoralists to move to further regions, for longer periods, or simply to occupy land demarcated for wildlife or protected species, instead of reducing herd size or harvesting with more frequency. As such, the high-density stock approach is at the centre of the debate and it has been criticized by members of the Tanzanian government, who point out this behaviour as the main factor contributing to land and natural resources degradation in this region. Those are the reasons supporting government attempts to limit pastoralists' movements. This has increased tension in the region and placed the debate about land and access to land onto the political agenda. For instance, the Loliondo Gate[75] is one of the hot topics

[75] The LoliondoGate reports on some scandal reported by the Tanzanian and International press regarding the Tanzanian government's attempt to slash a corridor of 1,500km^2 of dry season grazing

when using any internet search engine to find out about political facts in this region. Therefore, it seems plausible to claim that from the perspective of the Maasai pastoralist, if they are to maintain their culture, then they need to have large herds and be free to move around. However, this strategy is clashing with other perspectives, suggesting that it is not productive[76]. This leads to different and contested discourses and understandings of the changing world and opens a dialectic between users' needs and the implementers' vision. I return to this issue in the opening of chapter 8.

7.2.2. Market strategies and dynamics in Arusha

Before exploring this topic, it is important to explain some important aspects of the livestock markets' modus of operating based on my observations and information collected. There are some key determinants dictating the rules as to how negotiation and trade should be done: i) cattle condition (wealth and weight: factor #1); ii) the assessment (visual/aesthetic: factor #2); iii) negotiation (settling the price: factor #3), and in all of them there is one actor imposing his influence: the Laiboni.

Tradition (continuity) is somehow interacting with innovation (change) in the attempt to transform the livestock market is this particular region, where I collected information in markets such as Waso, Loliondo, and Mesarani. Observations made in those markets gave me reason to suggest that there are some specifics rules governing the interactions among parties when trading cattle.

Before sharing my observations, I need to explain that one of the markets I use as an example is Waso, which is a particular market. Potential research participants there were not very keen to talk about their business, mainly because the majority of them trade cattle with Kenyan traders in a process described[77] as Cross Border Trading. In this market, there are more Kenyan Shillings circulating then Tanzanian Shillings, and the volume of business is very high. Most of it involves animal trade of grades 1 and

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land bordering Serengeti National Park in order to extend the Game Controlled Area (GCGA). This was brought to my attention during a workshop organised by the Pastoralists Indigenous Non-Governmental Organizations (PINGOS) in order to set a strategy to deal with the Loliondo evictions. The workshop was held in Arusha, on the 22nd November 2013, when I was conducting my pilot study in that region.

[76] The former president of Tanzania Jakaya Kikwete once classified the Maasai way of living as not productive: http://www.theguardian.com/world/2013/mar/30/maasai-game-hunting-tanzania, accessed on 04/01/16.

[77] (Mr Manumbu, footnote #78 in the next page)

2 and a few of them Tanzanian Special, animals that in normal conditions should be arriving at Pugu Market in Dar es Salaam.

Based on the particularities of Waso market and my observations about the kind of animals I saw being traded there, the claims regarding Maasai pastoralists being owners of large herds comprising weak animals would not be applicable. The majority of the animals that I observed in this market were heavy and healthy animals (top grades). When exploring the reasons beyond this contradiction I found out a very interesting aspect of herd management, namely that amongst the Maasai keepers the goal is not only to have a large herd, as pointed out and criticized. The strategy is also to have a few good animals (factor 1) to take to strategic markets[78], such as Waso, and there trade them for very good prices with Kenyan traders, mainly because:

> *"in the local market, you will find a lot of cattle there and the price is not good, so we decide to go and sell in Nairobi, or Mwanza so we can get a good price."*
>
> **Interview#50 - Saringe Rago**

Based on observations done in this and other markets in this region and in conversations with some producers, it is possible to point to this as a strategy for managing risk, enabling them to become less vulnerable and increase levels self-righting, the same is to say becoming more resilient. Therefore, I argue that the perspective of large herds made up of poor and weak animals, is not what it seems to be. In this region, it is also possible to find animals of very good quality. This seems to be one of the strategies used by Maasai pastoralists to balance the risk of the high-density stock approach, and at the same time to provide conditions to be present in the livestock market with good animals (quality approach) and to conduct profitable business.

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[78] *"Then you have the trade with Kenya, there is this zone market, the livestock border market, where the animals (still talking about special animals) are being sold there, so the Kenyans are going there for the Maasai, and you can't distinguish which one is a Maasai from Tanzania and which animals are going to Kenya, because they know each other; they track, they graze, they go there and from there they graze and sleep there, so, you know, they take the animals there and they fatten and slaughter them there; That is, boundaries issues are very difficult to manage, special issue in the border from Lake Victoria up to Mombasa, and Tanga where the animals are crossing. I did a study in Crossing Boarder Trading, it is very interesting the informal cross border trading."*

Interview#2 - Mr. Manumbu

Awareness of this strategy forces me to look at the last stage of the production cycle, where some animals are placed under a special regime, called the fattening stage, which takes place normally after the *masika*[79]. This emerges as a strategy to respond to one of the market rules and practices: the aesthetic assessment (factor2). In this stage of the production cycle the importance of the weather is once again emphasised as a determinant variable to fulfil another requirement of the market rule, which dictates a preference for animals in good visual condition: health and weight (factor1). Therefore, weather conditions are determinant for the decision to harvest the herd and achieve the third aspect of the market rules: the price (factor3), as this is achieved by recourse to the aesthetic assessment based on the cattle's condition (factor1) which is determined mainly by access to good pastures resulting from a good rainy season. Therefore, we can conclude that rain is an important factor for determining if it is the right moment to approach the market and which market. When interviewing some of the actors in this region it was possible to understand that:

> *"the circumstances where [they] normally decide to sell is during the rainy season."*

Interview#50 - Saringe Rago

From the economic point of view, the equation seems to be: keepers want to sell as little as possible and to earn as much money as they can and reinvest one part to increase the herd size and, eventually, save the remainder, for the household economy. Pastoralists whom we interviewed shared some of the strategies they use to enlarge their herds. The examples presented below are illustrative of the trend in the region:

> *"I am business women, I buy livestock and keep them in my herd for a certain period, and after that I sell them, and according to the profit, I will decide what to do, part of it will be used to buy food and the surplus I will save*."

Interview #49 Easter Jakob

> *"Some time we go to the market just to visit, like today that I not selling or buying cattle.*

Interview #5 Philémon Olé Saipi

[79] This is the Swahili and traditional word for the long rainy season, which in normal conditions in the northern region of Tanzania is due to commence between the second and fourth week of March every year.

As such, information about weather forecasts and livestock markets are fundamental, mainly because it is this information that makes it possible to decide whether it is the right time and which market to go to. However, if the weather conditions are not the best and the rainy season has been poor then sometimes the producers will have to harvest against their will. For instance, it is said that after the endemic crisis of 1998 (please section 7.2.1.), some of the Maasai producers started to sell more than usual as a coping strategy.

The Laiboni ruling the clan plays a significant influence on this process (Fratkin, 2004, pp. 207-226), because it is claimed that he can predict rainfall and give instructions regarding the best moment to harvest the herd. Observations done in this particular site clarified that the Laiboni is highly respected in Maasai society. He has the power, and the instruments, inherited from his direct ancestors (father/grandfather), and he uses them to foresee the future and mediate tensions among the community members, mainly concerning livestock production and marketing. He is the one who normally gives the members of the clan information regarding the best moment to sell and the price that they should claim in the market, as the veterinary officer of Mesarani market, Mr Mlinga, noted:

> *"… they bring the animals here advised by the Laiboni and they estimate according to the feature: as the animal is: the body and health of the animal. And they say: 'if I go there I [pastoralist] can score 600 000(TSH) or 700 000 (TSH)'; and when they bring the animal here (to the scale) and they weigh I say: 'you will receive 480 000 (TSH)', and they say: 'I estimate from the Laiboni and I came here to get this much'. So, when we try to weigh the animals they say that they don't want."*
>
> **Interview#53 - Mr Mlinga**

This strongly suggests that the Laiboni's word is very respected and taken as the reference when bargaining in the market. If we analyse the role of the Laiboni, mainly in giving advice to sell, we will find that the advice derives from his capacity to predict the future and to forecast a good or bad rainy season, which will determine the abundance of grass. This will determine if it is the moment to harvest some of the good animals from the herd or not, as pointed out by the Laiboni of Maaloni village itself:

"If I there is a good rain, and good pastures then we can decide to sell many of them."

Interview#50 - Saringe Rago

Based on the above evidence, the rain pattern is a key factor not only influencing the management of the herds, as it is the factor determining the moment to approach the market and to sell. This can affect seasonal prices, which can go down when the market is flooded with poor quality animals' due to drought or go up when the market is trading only top animals resulting from a good rainy season.

In the light of this evidence, I can restate the perceptions regarding changes in the weather, mainly rain patterns, which determine which strategy is to be used when it is time to approach the market. If there is a good rainy season in view then they can plan to sell animals in faraway markets, because they will have the chance to graze and fatten the cattle during the journey, otherwise they prefer to go to the nearest market, as I was informed by this pastoralist:

> *"the decision to bring the cattle for selling [is] related with the distance I have to cover to reach the market; in order to get a good price some other traders should see the animals as heavy, we cannot trek the animals for long, they will lose condition. So, the criteria are always the nearest, […and] it depends on the price. If you hear that the prices this week are good in Waso market [which is far] then we go."*
>
> **Interview #48 - Raphael Manangoi**

This has opened a window to the past, where when in doubt, producers frequently failed to sell many animals, mainly when uncertainty was high and markets with good prices far away, and information regarding livestock market was rare or non-existent. This made them to base their action on traditional practices and where the Laiboni used to be the only source of information:

> *"They have followed our tradition, and the ones that don't follow and don't believe they are few and they are now living in cities. But those living in the Maasai villages they still believe in me. There are activities that we still do, in the traditional way, that bring people together and make then believe in the Laiboni. Those not believe in me they are few. You know, our [culture and] belief is very strong."*
>
> **Interview#50 - Sarangi Rago**

The above gives ground to claim that the Laiboni plays a key role, not only as the one with the capability to foresee the future, but also as a local regulator of the market. Advice regarding price is given by the Laiboni, and the bargain normally is based on the aspect of the animal, how good the animal is looking. In regard to this, evidence suggests that there are two factors, or triggers, pushing pastoralists to harvest the herd: **i)** when animals are looking good due to good rainy season, or **ii)** in the event of a

crisis. The visual or aesthetical assessment used as a rule in the majority, if not all, of livestock markets emerges as the reason for those options.

Therefore, the common practice of placing value in something that is perceived as not fungible, and that holds a high symbolic value; calls for this local regulator[80], the Laiboni. As such, it is possible to argue that the symbolic value of the asset in Arusha region determines largely the way that the Maasai approach the market, for instance making sure that they will be the ones trading the asset which only they can understand and place value (please see my Trust Matrix at end of section 7.3.2.). Therefore, their reluctance to put animals on the scale or to trust the asset to an intermediary, makes the role of the Laiboni critical, because he is the one with the knowledge to mediate the bargaining process, and explaining why the mobile phone is very important in this process for connecting the Maasai pastoralist and the Laiboni.

7.2.3. How movements impact on the herd: duality price/distance - Arusha region

In this section, I discuss issues of price in its relation to distance to be covered to reach a market with good prices and indicate which strategies are used to manage animal appearance in this region. The mobile phone is one of the resources used to sort out those issues, but this will be discussed in more detail in the next two chapters. In this chapter I shall just signpost it as a tool to help keepers to manage the duality price/distance, as the animals

"*should be seen as heavy and wealthy [as possible] when arriving at the market*".

Interview#48 - Raphael Manangoi

Therefore, the option to transport animals, either by lorry or trekking, to their final destination (market or abattoir), influences the time expended (hours or days) to accomplish this process, and this is perceived as very important because it can jeopardise the full production cycle. The issue is that the cattle to be sold need to reach

[80] It is not possible to identify the Laiboni as a middleman since his role, and respect that he holds within the clan, go beyond and above the role of the middlemen. However, some of the usual tasks that are normally carried out by a middleman in other regions are undertaken by the Laiboni in Arusha region.

the market very quickly and looking good, as the physical/visual aspects will prevail there, as pointed by the Zoo Sanitarian Inspector of Pugu market in DSM[81]:

> *"Grading animal is by using physical observation, taking condition [my interviewee showed me a kind of catalogue with some picture of cattle]: this is grade 1; this is grade 2; this is grade 3, this is grade 4, this is grade 5 and this is grade 8 [grade 1 is top animal and grade 8 very poor]. In this market only from grade 3 is allowed to market for slaughter, beyond that may be sold for fattening or any other reason, but not for slaughtering."*

Interview#19 - Mr. Shasha, Zoo Sanitarian Inspector at Pugu

This determines that the movement and transportation of cattle to market is a very important process within the production cycle, not only to ensure that the animals will arrive at the destination in the best condition possible but also to avoid loss. Different strategies are put into place according to region, financial resource, distance, and final destination. These are some of the aspects that I will be covering in this section. I will start by emphasizing that through my observations from a substantial part of the territory, from DSM (East/Coastal zone) to Iringa (Southwest), and from Dodoma (Centre) to Maswa (North), it is possible to claim that the most common option to move cattle is by trekking the animals, mainly to search for pastures. Motorised vehicles are often used when the option is to take the cattle to a secondary market or to the abattoir, because, as noted, it is fundamental to preserve the condition of the animals until this destination, as pointed out below:

> *P/A – Yes, he also uses a lorry man, but sometimes he can trek the animals up to the abattoir.*

Interview#55 - Mr Maulid – *Dalali*

Therefore, articulation and planning of cattle movements is vital within the production cycle, because it helps those actors to manage more efficiently the daily distances that animals will need to cover. For instance, when it is time to sell, both pastoralists and agro-pastoralists avoid going blindly to the market, because certainty is crucial, and is a fundamental variable to bear in mind. Producers normally only choose to transport cattle to a faraway region when they are sure that they will obtain a good price:

> *"… [because] sometimes it took five days to get to Nairobi and sell the cattle there. So, it is important the role that mobile phones are playing now, it plays a better role,*

[81] The animals are sold in the market based on an aesthetic assessment. Rarely the scales are used to take the body weight of the animal.

together with other infrastructure such as the road, many cars going from one place to the other, so now it is much easier to find information. So, mobile phones are helping us to do our businesses."

Interview#50 - Saringe Rago

The mobile phone is a key artefact in use during production or marketing stages, as it is vital for gaining access to key information, such as good pastures or to coordinate and to facilitate transportations arrangements. For instance, amongst the Maasai and even if the oral information still plays a relevant role, mobile phone was the frequent answer to my questions regarding ways to obtain information regarding grazing areas or regarding prices in faraway markets, as noted below:

"R/Q - And which approach do you use more nowadays. Do you use more often the mobile phone, or do you prefer to go there, or to send the messenger, and to search for the price.

P/A - we use the mobile phones and then we go."

Interview#50 - Saringe Rago

Supported by all evidence produce so far and the observations done during the fieldwork, I suggest that the mobile phone seems to be reshaping the notion of space and time for those actors and helping them to manage some production constraints with more efficacy. For instance, distance emerges now as more manageable and time as more flexible. As such, pastoralists and agro-pastoralists are suggesting that now they can speed up and/or reduce the time associated with their tasks, mainly when they gain access to information flowing from any other region. In my interpretation, and in a very practical way, they seem to suggest that the mobile phone gives them the possibility to resolve some production complications at any time of the day and at any distance. Physical barriers and time constraints are being removed by this technology, therefore empowering and making those actors becoming more self-reliant, therefore increasing chances for those to self-right after any event of shock.

Consequently, at the marketing stage the device has reinforced the producers' capability to bargain, as shown in this short dialogue with a trader I interviewed in Pugu market just after he concluded a deal with a buyer from a distant region:

R/Q – if you didn't have the mobile phone with you today, or in the time when the mobile phones were not out there, how would you solve the bargain with this buyer?

P/A – It would be impossible, in the days before the establishment of the mobile phone you were supposed to go there, miles away from here to solve the problem, it would be impossible. Now, I can communicate from miles away.

Interview21-Ramadam Athuman - Trader

The above quote is representative of those actors' opinion concerning that technology. It indicates one of the strategies used by producers to tackle difficulties inherent in the need to move the cattle searching for pastures (production stage) or to transport the cattle to the market (marketing stage), which is a pressing issue and an important production factor to be managed. It also helps to illustrate which strategies are being used to manage old constraints such as the need to have to relocate the herd from one region to another without knowing for sure if they will have access to good grazing areas on the way, or to markets with attractive prices. This helps to illustrate the extent to which the device is changing the way in which pastoralists are managing some of the production stages, and how they perceive the context where they are immersed, which is now becoming more fluid and affording possibilities for action.

Consequently, there are grounds for claiming that the device in empowering those actors and help them to deinstitutionalize some agencies that were traditionally within the livestock market and confined to middleman and traders. Information enabled by this technology is reinforcing the producers' power to bargain. This shifting of power agency is taking place through mobile use, but not in the way anticipated by policy actors who decided to implement LINKS as the instrument for providing support for the decision-making process, which I will discuss later in section 9.3.1.

This last section has emphasized matters involving the Maasai pastoralists and the Arusha region. The next section focusses on the Wasukuma and the Lake Zone. The topic of transportation will be explored more thoroughly in the following chapters. Before I move to the next section. I will introduce a flowchart with the process of production and marketing In Arusha. The same will be done for the Lake Zone at the end of section 7.3.3.

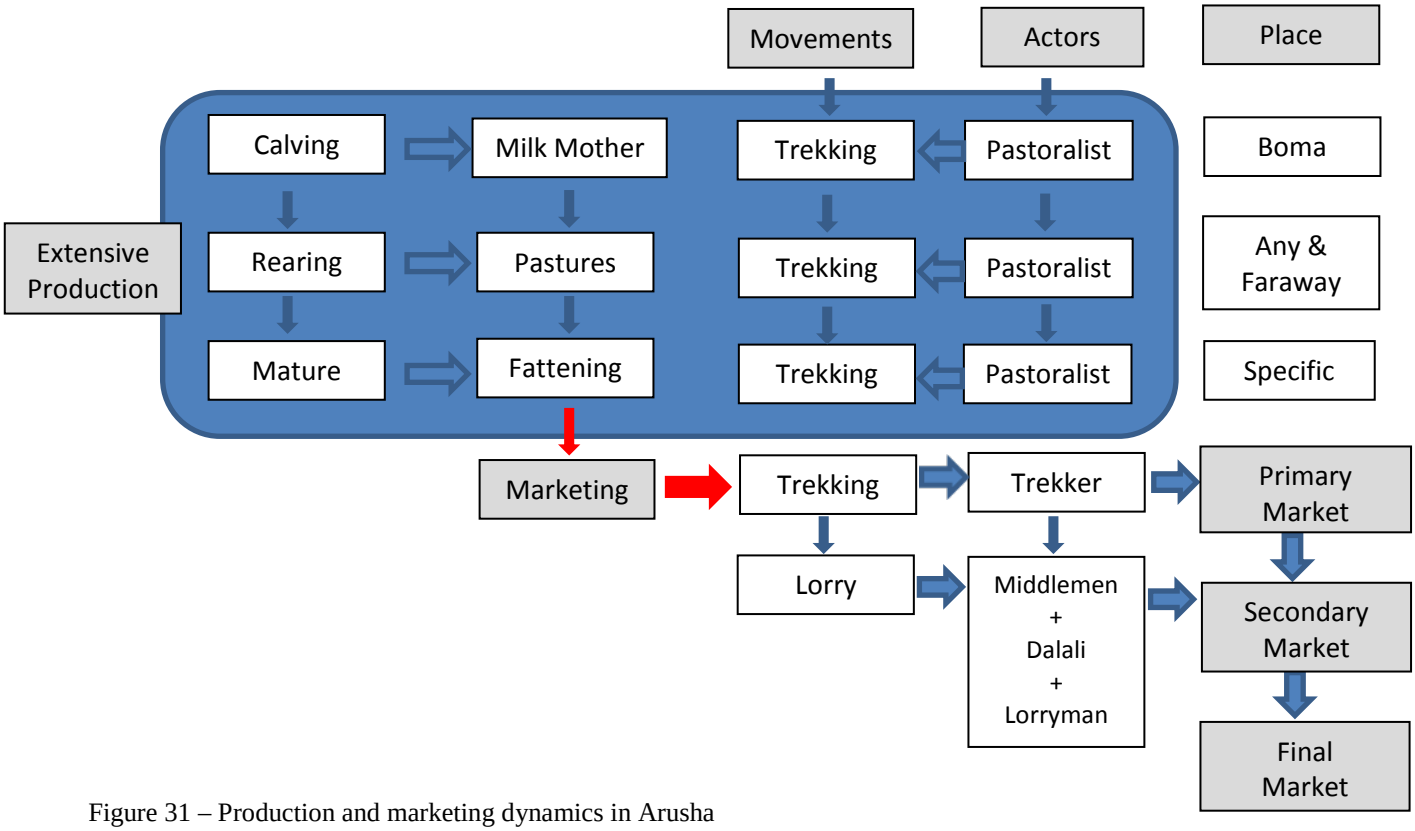

Figure 31 – Production and marketing dynamics in Arusha

7.3. Livestock production in the Lake Zone: the innovative behaviour of the Sukuma

In this section, I shall focus on the other region being compared: The Lake Zone, which is constituted by 7 regions: Geita, Kagera, Kigoma, Mara, Mwanza, Shinyanga and Simiyu. The region is situated in north-western Tanzania, near the southern shores of Lake Victoria, and comprises two of the most important cities of Tanzania (Mwanza and Shinyanga) which are inhabited mainly by the Wasukuma tribe. The territory is divided into 12 administrative districts. In respect of weather and rain patterns, the Sukuma land has predominantly high patterns of rainfall extending from November to March. This makes the region one of the most important and productive Agricola regions of Tanzania. I visited 4 out of the 7 regions that constitute the Lake Zone.

Data were collected in Mwanza, Shinyanga and Simiyu. In those regions I was able to visit 6 key livestock markets, 3 of them taking part in the LINKS monitored market chain, namely Nyamongolo (Mwanza), Shanwa (Maswa), and Tinde (Shinyanga), and another 3 not taking part in LINKS but with good trading dynamics, namely Seke (Shinyanga), Senani (Maswa), and Bariadi (Bariadi).

7.3.1. Exigencies of pastoral herd management and strategies to manage these challenges in the Lake Zone

I will now focus on livestock management in the Lake Zone and on factors impinging upon production dynamics in this region. Concerning production systems and when characterizing the Wasukuma producer a key characteristic emerges: they are agro-pastoralists, and this constitutes a major difference from the Maasai producer. Recent studies conducted in Shinyanga region produced statistics reinforcing this characteristic. For instance, a study involving 200 participants revealed that approximately 93% of the Wasukuma rely on both crop and livestock production, and of those 200, just 6% relied solely on crops and 1% relied solely on livestock keeping (Selemani et al., 2012).

Regarding production strategies, and in contrast to factors impinging negatively upon Maasai producers, access to land is less critical for the Wasukuma, especially

regarding access to areas to graze their herds. The study by Selemani *et al* suggests that those agro-pastoralists support their decisions about access to forage and forage management fundamentally with local knowledge, emphasizing the practice of *Ngitili*, which implies the communal use of land, as one of the strategies to manage production dynamics. *Ngitili* is a traditional strategy used by the Wasukuma to manage natural resources, and includes tree planting, fencing and creating several feedlotting areas[82], and most importantly there is the practice of regularly moving livestock between those specific areas reserved to feed cattle.

I did not find any evidence in the literature, nor during my fieldwork, suggesting that this practice was being carried out in other regions. It is a coping strategy for managing land and forage for the animals that has been practised over time by the Wasukuma in the Lake Zone. In the past, it was conducted under a public and communal perspective, and consisted in reserving a large portion of land during the rainy season and only opening it to feed animals in the high peak of the dry season. Today however, due to extensive use of land and poor use of the technique, the strategy is accomplished with a different perspective, which they call the private *Ngitili*, where producers manage a small portion of private land.

This practice, side by side with the appropriation of mobile phones, is allowing them to become more resilient and overcome some of the most prominent risk factors which were noted in the first half of this chapter, and which persistently affect the Maasai: lack of pasture. A key factor facilitating the implementation of *Ngitili* is that producers in this region are more sedentary, and fertile land and water resources are more abundant than in Arusha region. Therefore, farming became traditionally their primary activity notwithstanding that they kept cattle simultaneously. This represents their way of life, which is based on the growing of crops and the raising of livestock, and it represents the primary means of economic activity. They rarely practice pure pastoralists, as pointed by this agro-pastoralist I interviewed in Shinyanga:

> *R/Q - and what kind of livestock keeping do you do, are you a farmer or do you do pastoralism?*
>
> *P/A - I do farming!*
>
> **Interview#26 - Kashinje Tungu**

[82] Feeding yards

This is the trend in this region, and when they say farming they mean activities done in the specific place where they live, consisting in planting crops and raising livestock. The word frequently used to characterise the place of action is the *homestead,* which contrasts with the *boma*. This is a fundamental aspect of what I suggest is distinctive of the Wasukuma character, i.e. they tend to stay in one place, or as they say in their original language (Bantu) *nye-nsukumale aha* (let me camp here).

This traditional land conservation practice referred to as *Ngitili* has helped the Wasukuma to manage herds and production dynamics more effectively than the Maasai, and therefore have been better able to challenge and overcome some of the constraints pointed out earlier. Intrinsically, the flexibility to move, resorting from the increased capacity to negotiate with other farmers' access to private *Ngitili* to feed the cattle associated to feedlot regimes[83], is a key aspect facilitating the exigencies of herd management in this region.

The region depends traditionally on maize and cotton, which are the heaviest cash crops in this region. They are cultivated on average on about 45% of the cultivated area, and maize competes with cotton for land, labour, and farmers' cash. It is in coping with this particular struggle that most of the agro-pastoralists adopt the strategy of using cattle as animal draught power in the homestead, and trading cattle as complementary to cotton and maize production.

Regarding the herd management, evidence from my data collected in this region suggests that the frequency of moving (short distances) the animals is the main component of agro-pastoralists' strategy, adding to the fact that natural resources are more abundant in this region than in Arusha, making cattle movement easier to undertake. Reinforcing this, the agricultural output, mainly the maize crops surplus, is used to feed the herd. Consequently, they have better and fewer animals per capita, and they tend to keep the animals for a shorter time than the Maasai, i.e. the renovation cycle is more frequent.

[83] Feedlot is a type of animal feeding operation typical of intensive farming. Nevertheless, in this region the regime is semi-intensive, therefore producers introduce some ration in parallel with grazing.

This means that they are able to put more and better animals in the market as emphasized by the Livestock Marketing Officer in Shinyanga, Mr Shehe Mganga, when pointing out some of the reasons why there is a predominance of cattle from the Lake Zone in Pugu market:

"R/Q – So 70% of the cattle sold in Pugu is coming from the Lake Zone, and why is this region so critical for the livestock sector, why do we have more cattle in this area?

P/A – because is a big area, and there are more pastures, especially during the time of rain.

Interview#25 - Mr Shehe Mganga

Besides *Ngitili*, the dual agricultural systems of production (crop and livestock keeping) that characterize the region are reported by producers themselves as helping them managing their herds, because they decrease dependence on pastures for livestock. Besides that, the use of cattle for draught animal power during the crop season helps to increase productivity, and therefore augments surplus to feed the herds. The presence of cattle in homestead as is a sort of practise and using livestock as assets, which correspond to the answer of a small number of agro-pastoralist interviewed. Conversely, a significant number of interview participants justified livestock keeping as necessary to cultivate during the rainy season, when they have to seed the maize or cotton crops, as illustrated in the interview with Kashinje Tungu, an agro-pastoralist, in Tinde market, Shinyanga region:

R/Q - How many head of cattle do you have?

P/A – 18.

R/Q - and how many have you brought to the market today?

P/A - Today I just came to buy.

R/Q - and have you purchased any animal?

P/A - I have purchased just one.

R/Q - and you are planning to buy more?

P/A - No.

R/Q - and this one you have purchased is a male or a female?

P/A - It is male.

R/Q - and why a male?

P/A - I chose a male because the rainy season is coming, and I can use the animal to work the land.

Interview#26 - Kashinje Tungu

This reinforces the fact that farming is the prime activity in the region, with livestock keeping as complementary activity, which is not exclusively to these farmers. For instance, a *dalali*[84] interviewed in this region pointed to farming as the alternative to livestock trade:

> *R/Q – and when there is no business in the livestock sector, because the keeper doesn't have enough animals, or the buyer don't want to buy animals, how do you manage your life?*
>
> *P/A – I do some farming.*
>
> *R/Q – so you have a farm and you do farm, what do you produce?*
>
> *P/A – cotton.*
>
> *R/Q – how many hectares do you have?*
>
> *P/A – 2 hectares.*

Interview#28 - Juma Mwando - Tinde MKT

The above quotes illustrate some of the options of producers in Lake Zone, and reveals differences between the Wasukuma and the Maasai, even if some specific issues are common to both group of producers, such as climate changes, lack of information regarding livestock marketing and basic infrastructures within the markets. However, there are more differences than just producers' behaviour. A series of factors, natural and social, favour production in this region. As noted already, the practice of *Ngitili* has favoured production dynamics over the years, mainly concerning land usage.

In what concerns technical resources, Lake Zone in general has better basic infrastructure, with an eco-system/industrial cluster not existing in the Maasai parts of Arusha region. The gap between the two regions is growing resulting in a contrast between more traditional (continuity) and more innovative (change) systems. More specifically, the flexibility resulting from the increased capacity to negotiate with other farmers' access to private *Ngitili*, is a key aspect facilitating the management of natural resources, and therefore facilitating production strategies in this region. That – the capacity to negotiate – is one key aspects emphasized by literature on resilience, namely the possibility of one being able to bounce back after being exposed to shock.

[84] The Dalali is a sort of informant/facilitator operating traditionally in the livestock market who knows almost everyone and is very well connected, helping to arrange business and transport for the traded cattle.

7.3.2. Markets strategies and dynamics in the Lake Zone

The previous section aimed to introduce the factors influencing production and marketing trends in the Lake Zone, following the same methodology used for describing those aspects in Arusha region. The aim was to help to identify which differences exist between the two regions in respect of herd management. Now I shall explore the differing market dynamics.

In the Lake Zone, market day is a day of celebration, a sort of public holiday, and "*the market is the place to be"*, as emphasized by one passer-by we spoke with in Bariadi. This is in contrast to Arusha where the market is seen as a serious place, and a place to conduct businesses, and not just for killing some spare time, trusting to the middlemen, *garagaja* or the *dalali* to conduct the business. In that sense, I can say that the Maasai people are more circumspect and serious than the Wasukuma, who are less cautious and more relaxed. This makes the *market* atmosphere intense in the first region and fluid in the second, although this does not mean that both the Maasai and the Wasukuma do not perceive the *market* as a very important place.

This influences the trading rituals and rules. For instance, the Maasai by tradition want to trade directly and to follow the Laiboni indications, the middlemen being the last resource to be used, whereas in the Lake Zone region trade is normally done using the *garagaja* (middleman), or the *dalali (facilitator)* as intermediaries. This is why those middlemen emerge as a key point of contact, and it is normal for middlemen to contact the farmer and then visit the homestead, if needed, to assess the cattle and to set up the deal, and in some circumstances to ensure transportation of the cattle to market. The involvement of middlemen is one of the reasons determining those producers' options. This option of using the middlemen as the negotiators to trade their animals is characteristic, as frequently noted it is rare the circumstances where the farmers will be the ones selling directly, the justification given is that they:

> *"… prefer to use the dalali because he knows the big businessman. We are keepers, we don't know who the people are coming to buy. That's why we preferred to use the dalali."*
>
> **Interview#26 - Kashinje Tungu**

The two regions contrast in other respects of market dynamics. In Arusha, the Maasai pastoralists tackle deprived circumstances by harvesting their herds more than they would like, while in Lake Zone agro-pastoralists keep a large system in place by selling, buying or exchanging animals strategically and according to the season and their needs. Also, by having small herds, producers in the Lake Zone can promote the frequent rotation and movements of the herds, a strategy that favours the improvement of the herds and grassland across the region. When allied to the way in which cattle are perceived (cattle in this region have a more material and objective value, i.e. fungibility) that allows producers to approach the market more frequently and to increase the volume of trade, as pointed out in the short dialogue presented below:

R/Q – Beside these cattle you have bought and sold in this market today, do you keep any animals?

P/A – Yes, 5.

R/Q – and those animals you use them for what, for work, to produce milk, or as an asset to boost the business in a certain market?

P/A – I use them as an asset or capital.

Interview#41 - Pauline Sene - Trader

In Lake Zone, the material value (fungibility) of the asset gives producers more guarantee that they will receive what the asset is worth, and therefore they do not mind delegating, or entrusting, the cattle to the *garagaja* i.e. the middlemen. Concerning this option, there are conventions ensuring that they will receive what the cattle are worth, as suggested below, which represents the trend in the region:

P/A – the situation is, if the keeper gives me his cattle and I sell it below the price he wants, it will make the relation weak, but if I sell it and give to the keeper the price he wants it will make the relation strong.

R/Q – Ok, in my perception, in my way of thinking that is called trust, it is the same for you?

P/A – Yes, I call it trust.

Interview#28 - Juma Mwando - Tinde MKT

Therefore, this objective way of perceiving cattle, very different from the subjective and high symbolic relationship that the Maasai have with cattle, influences the dynamics of the livestock market between the two regions. If we were to describe the

market dynamics in those two regions, it would be by underlining the two contrasting states of the interchangeable world: a dialogue between the symbolic and the material. I suggest that this is why it would be easier to implement more institutionalised market relations and associated regulations, as envisaged by LINKS, in the Lake Zone. There is a material (by opposition to symbolic) system of valorisation of the herd as described below:

P/A – I have 15 head of cattle.

R/Q – and what is the aim of this 15, is just to keep, or they are assets to sell one day. Why are you keeping them?

P/A – They are just assets, […] and I use them also as a source of power in the farm.

Interview#39 - Macele Yoana, Keeper

Producers in Lake Zone are immersed in an atmosphere of objectiveness (fungibility), resulting from a conjugation of different socio-economic factors prevailing in this region. That allows them to produce with more quality and to rotate the animals more frequently, thus determining a more profitable dynamic to the market and allowing them to avoid moving their cattle too far in order to reach a good price.

Two systems of valorisation exist; the subjective (nonfungible) in Arusha and amongst the Maasai and the objective (fungible) in the Lake Zone amongst the Wasukuma. This makes trust to be perceived differently amongst the actors in the market. The Maasai producers will have to cover more miles to trade and to search for better prices than the Wasukuma producer, a consequence of the subjectiveness (unfungibility) that exists in the trading system on which the Maasai rely and makes them the ones needing to trade their own animals (please see Trust Matrix at the end of this section).

In a more abstract sense cattle in the Lake Zone seems to be assessed from a more objective perspective (fungible asset, i.e. a bull it's a bull, a heifer it's a heifer), in contrast to Arusha where the Maasai persist in seeing the cattle as a symbol of their identity and status, thus determining that cattle are interpreted in a symbolic and subjective way regarding its value (nonfungible assets, i.e. each bull is one particular bull). This is the probably why they do not trust the cattle to any middlemen to trade on their behalf. Analysing this in a more conceptual way I would say that there is a

difference in trust between the two regions. In the regional market relations and dynamics, trust needs to be more explicit in Arusha, therefore more *mechanical*, whereas in the Lake Zone it is gradually becoming more *organic*, as shown in the trust matrix in figure 32. I shall return to this analysis in the discussion in chapter 10.

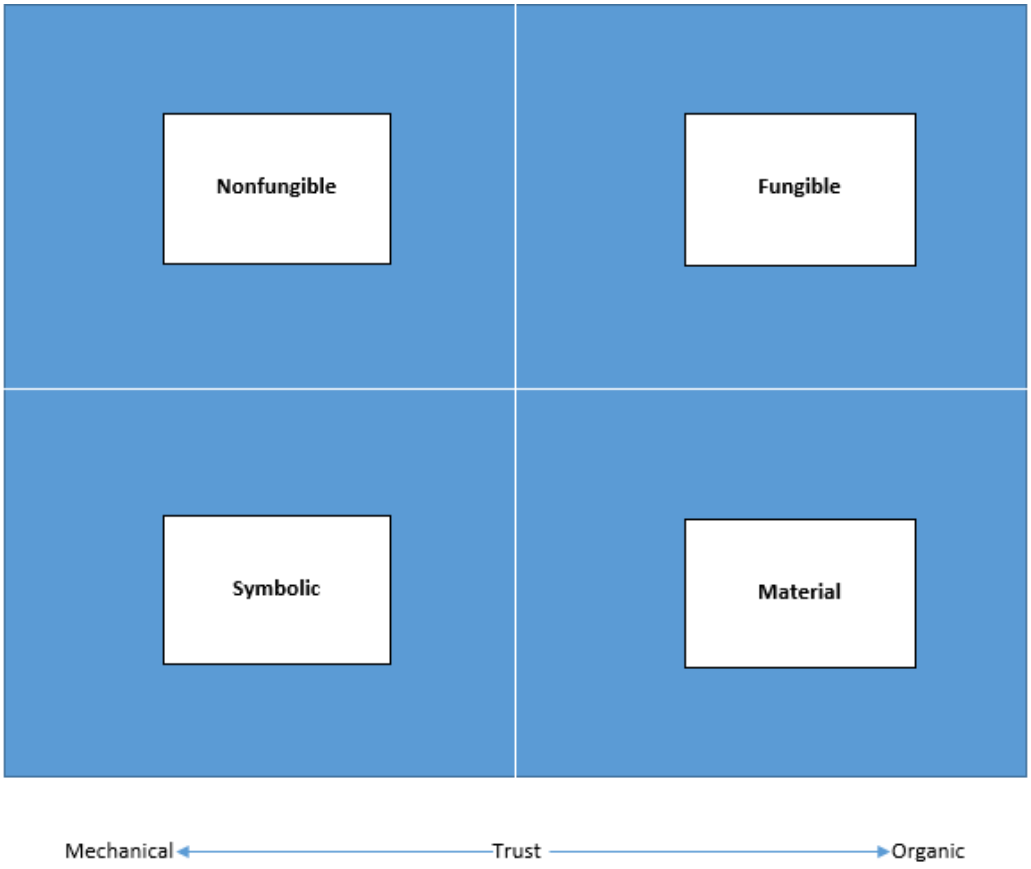

Figure 32: Trust matrix (created by the author)

7.3.3. How movements impact on the herd: duality price/distance – Lake Zone

In the previous section, some snapshots were given of how movement and rotation affect both production and market dynamics. These issues will now be explored further by describing how the important duality price/distance is managed. However, it is important to note again that the condition in which the cattle arrive at the market in this region it is also critical. Nevertheless, producers in the Lake Zone have different resources for managing this duality.

During fieldwork, I observed that producers in the Lake Zone have to move less than in Arusha, which is normal considering that they are agro-pastoralists and they are sedentary. However, sedentariness does not in itself explain everything. The producers are sedentary because that is part of their own way of life and taking into consideration the characteristics of the region: there is more abundance of natural resources in this region. These factors, in conjunction with some traditional practices of land management (*Ngitili)*, and inherent resources, allow them to avoid having to move their cattle too far. Concerning this matter those agro-pastoralist were unanimous in what concerns alternative strategies to feed the herd:

> "*I have my places (private Ngitili) where I keep the cattle, so I take them there and they graze. But also, we have the remains of the crops, so we use this to feed the animals […]".*

Interview#26 - Kashinje Tungu

This constitutes an outstanding difference between the Wasukuma and the Maasai, Lake Zone and Arusha, where the long trekking, searching for good pastures, lead cattle to lose condition. In the Lake Zone, there are more roads and markets than in Arusha, which together with local production factors makes it easier for producers in the Lake Zone to avoid having to move far, and when they do have to it is easier for them to made arrangements to transport the cattle, such as for instance to DSM:

> *R/Q – So, it means that when he (lorry man) comes from Dodoma with the cattle, that cattle is not only from Dodoma, it is from different regions and assembled in Dodoma to fill the lorry and to come here?*
>
> *P/A – Yes, the cattle is from different regions, from Mwanza, Singida, Arusha and some other regions.*
>
> *R/Q – So, they contact other agents in Shinyanga that is time to come down and fill the lorry and to come here?*
>
> *P/A - Yes*

Interview#20 - Charles Kasuka

The Lake Zone then, the mix of natural and infrastructural factors means that large distance migration of cattle is not necessary. For instance, cattle from this region sometimes arrive at the market already sold and just to fulfil formalities. More frequently, producers will sell in a near market using preferably the *dalali* to ensure

transportation and the *garagaja* to trade inside the market, as pointed out and illustrated below:

> *"We will contact the drivers, or we contact the dalali and this one will do the arrangement to bring the cattle here (DSM).*

Interview#22 Mwando Makenze

The abundance/concentration of markets in the region gives them the opportunity to visit more them one market per week, which puts the Wasukuma and the Lake Zone in a clear position of advantage in relation to the Maasai pastoralists and Arusha region, where *markets* are sparse, and producers will normally visit just one per week. In discussing this issue with a young trader in Seke market, he said that it is normal for him to visit at least two markets per week such as:

P/A – Nhasamba and Malambaka.

R/Q – and those are further than this one?

P/A – yes, they are further than this one.

R/Q – and do you also trek the animals there?

P/A – yes.

R/Q – how long it takes?

P/A – around 3 to 4 hours.

Interview #24 DJufungo

The existence of more resources and infrastructures (tarmac road and availability of motorised vehicles), allows them to claim that the distance to be covered seems short, and they can approach faraway markets easily without adversely impacting the herd. This also provides the opportunity for different activities and occupations to emerge within the market. The *wasuwagaji* (trekking man) is one of the occupations that constitutes a form of livelihood in this region. This does not exist in Arusha region, where there are herders' boys, but those have a specific function within a given age set and being a herder boy is not an occupation but is a stage in the lifecycle.

In the Lake Zone, the *wasuwagaji* normally trek small numbers of cattle on behalf of producers, middlemen or traders who want to increase their profits or who do not find it necessary to use a lorry for a short distance within the region. Therefore, they opt to

trek the small herd for these short distances because they know that this will not affect the quality and aesthetical aspect of the animals when they reach the market, as pointed out by Mboje, a *wasuwagaji* interviewed in Senani market:

"R/Q – Can you tell me what was the longest distance you had to cover to transport cattle from one place to another?

P/A – From Ikigijo to this market I covered 6km, but the longest distance was 12 km, and they paid 15 000 per head to take 9 heads of cattle, normally I don't bring cattle from far.

R/Q – 9 cattle and it was from this region?

P/A – Yes, normally I don't transport cattle from other districts."

Interview#36 - Mboje Lukumanya

Consequently, the binominal price/distance in this region is not as critical as it is in Arusha, where trekking emerges as a need or as compulsory, mainly when searching for pastures. In the Lake Zone that it is not so pressing, and it is one more option that is available for producers, middlemen or traders to made use of if they want to increase profits and not to send a small amount of cattle from a primary to a secondary market to be re-sold there, as pointed out in the next quote:

R/Q - After you have taken the cattle from the producer what do you do?

P/A – Normally I will take the cattle to the market and look for buyers.

R/Q – So you don't contact any buyer, you just collect the cattle from the producer and try to sell it in the market?

P/A – Yes, that is it.

R/Q – And how do you bring the cattle from the keeper to the market, do you do it yourself, you rent a lorry, or do you pay someone to bring the cattle?

P/A – I contact the wasuwagaji (trekkers) to bring the cattle.

Interview#28 - Juma Mwando

The Wasukuma agro-pastoralists have more options for setting up particular strategies to tackle the factors constraining production and marketing dynamics. Fundamentally, they base their production strategy on local knowledge, pinpointing the practice of modern *Ngitili*. This is a key aspect facilitating the management of herds and the natural resources in this region and decreasing the need to move the herds to too far.

Also, the dual system of production (crop and livestock keeping) that characterizes the region, is suggested by producers as key to overcoming and managing the environmental crisis, and therefore decreasing dependence on pastures for livestock, even though there is more availability of land and water, when compared to Arusha. This generates better conditions for the diversification of agricultural activity, which allows the Wasukuma to be more established and thus more readily enrolled in the development of a more institutionalised market relationship, as envisaged by LINKS. As I have done in the previous section, I now introduce the flowchart representing the Lake Zone production and marketing process.

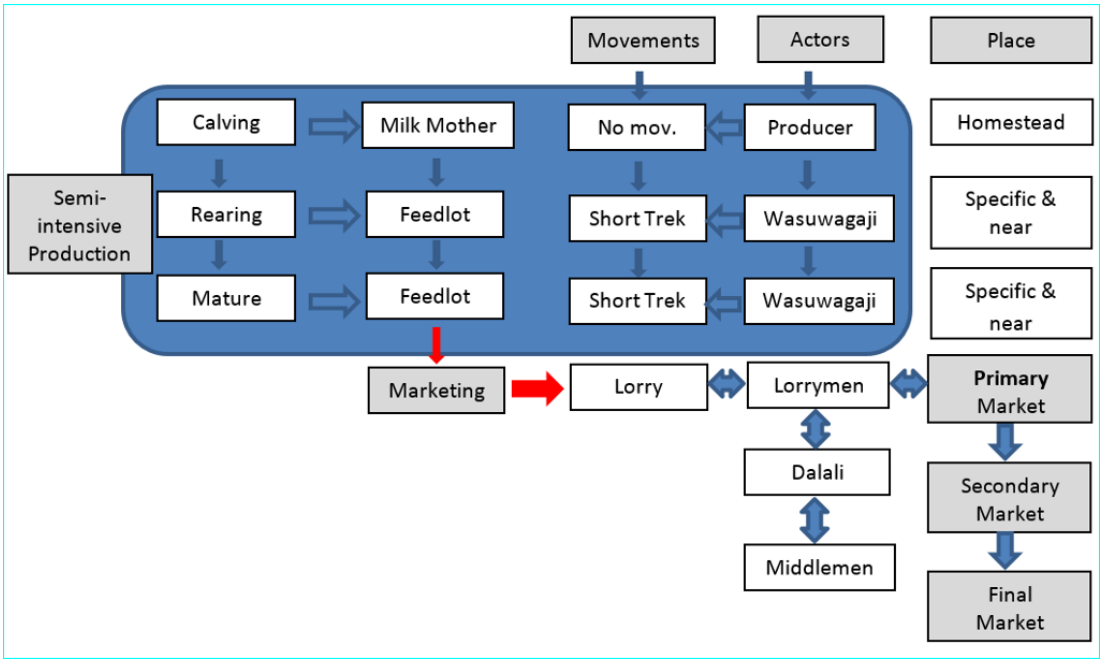

Figure 33 – Production and marketing dynamics in the Lake Zone

7.4. Concluding Remarks

This chapter has analysed livestock production in Arusha and the Lake Zone. Differences between the two regions were described and explored including the risk factors and strategies influencing production factors in both regions. The low versus high-density stock approach is one clear dichotomy when comparing those two regions. Analysing this regional market dynamic in a macro view makes it possible to argue that, on the one hand, there is evidence to support the idea that Arusha region is

stagnating in a traditional (continuity) and artisanal perspective and, on the other hand, that there is innovative (change) behaviour taking place in the Lake Zone, which is enhancing the production and favouring some local knowledge to flow with more intensity and in innovative ways.

Two important locations in those regions can be used to exemplify. For instance, cattle in Shinyanga are held in small herds usually with fewer than 20 head of cattle per domestic homestead, being on average grade 2 (best animals are grade 1 and Tanzanian Special). In contrast, in Ngorongoro the norm was large herds, over 50 head of cattle per pastoralist, where the average is grade 3 to 4 (grade 1 and Tanzanian Special are seen in markets in this region only in very specific circumstances).

The ongoing shift of land management and possession, from the communal to private or public perspective and the policy of corridors, dictates the constraint or the freedom to move, and affects production dynamics. Access to more sources of information, previously weak and negatively affecting livestock management, changes the number of visits to market. Distances expose the Maasai producer more than the Wasukuma. Thus, the Maasai need more reliable sources of information to support the decision-making process on time to sell.

In Arusha, the mobile phone is critical to link producers to the Laiboni, the person with the authority and knowledge to mediate the bargaining process, and whose authority explains why the presence of the middleman or of the *garagaja* is not as manifest in markets in Arusha region as it is in Lake Zone. However, both pure pastoralists (Arusha) and agro-pastoralists (Lake Zone) have now more opportunities to access market information using the mobile phone, as it will be explored in the next chapter.

The two regions also differ at the level of how the market is perceived, emphasizing the dichotomy between rigorousness and flexibility, e.g. there is more formality (tradition/conservative/continuity) in Arusha and in the Lake Zone more informality (modern/innovative/changing). This makes it possible to conceive the Maasai people as more circumspect and cautious, and the Wasukuma as relaxed and less cautious, making the market atmosphere flowing from intensive in the first region to fluid in the second. This influences the trading rituals and rules and makes trust to be understood differently in each place. As such, and before I close this chapter, I will summarise

three set of factors I have identified as influencing production dynamics in those two regions:

i) **Risk Factors**: Environmental; Structural; Strategic and Operational

ii) **Production Factors**: Access to nutrients; Animal health facilities and resources; Triggers for the decision-making process, and Transportation facilities and other Infrastructures

iii) **Market Factors**: Distance; Assessment Mechanisms; and Rules and Practices

Those factors will positively, or with less severity, affect production in the Lake Zone, and with more severity Arusha and the Maasai producer. Consequently, this influences the assessment mechanism and bargaining power of each group of producers. Adding these factors together leads to the conclusion that the Lake Zone has better conditions for performing in an institutionalised market relation perspective than Arusha. Therefore, it is not surprising that the biggest volume of cattle found in Pugu, which is the final market in Dar es Salaam, come from the Lake Zone. Nevertheless, the mobile phone now plays a key role in helping both the Wasukuma and the Maasai producers to find critical information in order to suppress or to moderate production and market constraints, and that is the focus of the next chapter. Before I conclude this chapter, I shall introduce a table showing the main factors working as constraints or facilitator, which are presented in the table in the next page. The aim is to compare visually the predominance of different factors influencing production and marketing in one and the other region.

However, I have to clarify that this is not a quantitative table, the variable presented result from information collected (interviews) and the observations made. That said, I should explain the methodology used to construct and to interpret the table. There are the columns in the vertical, which represents each of the three risk factors; then in the horizontal there are four lines and each of which representing the existing resources to address that risk factor. The red colour is used to represents Arusha and the green the Lake Zone. The scale will evolve from 0 (minimum) to 6 (maximum).

Resuming, the table provides the opportunity to observe concisely, in which way the lack or abundance of those factors can impinge upon production in the two regions. The table also make it possible to cross information at a multilevel dimension; and how those evolve against or in favour of the livestock keepers, evoking the opposing reality where those three factors emerge intertwined.

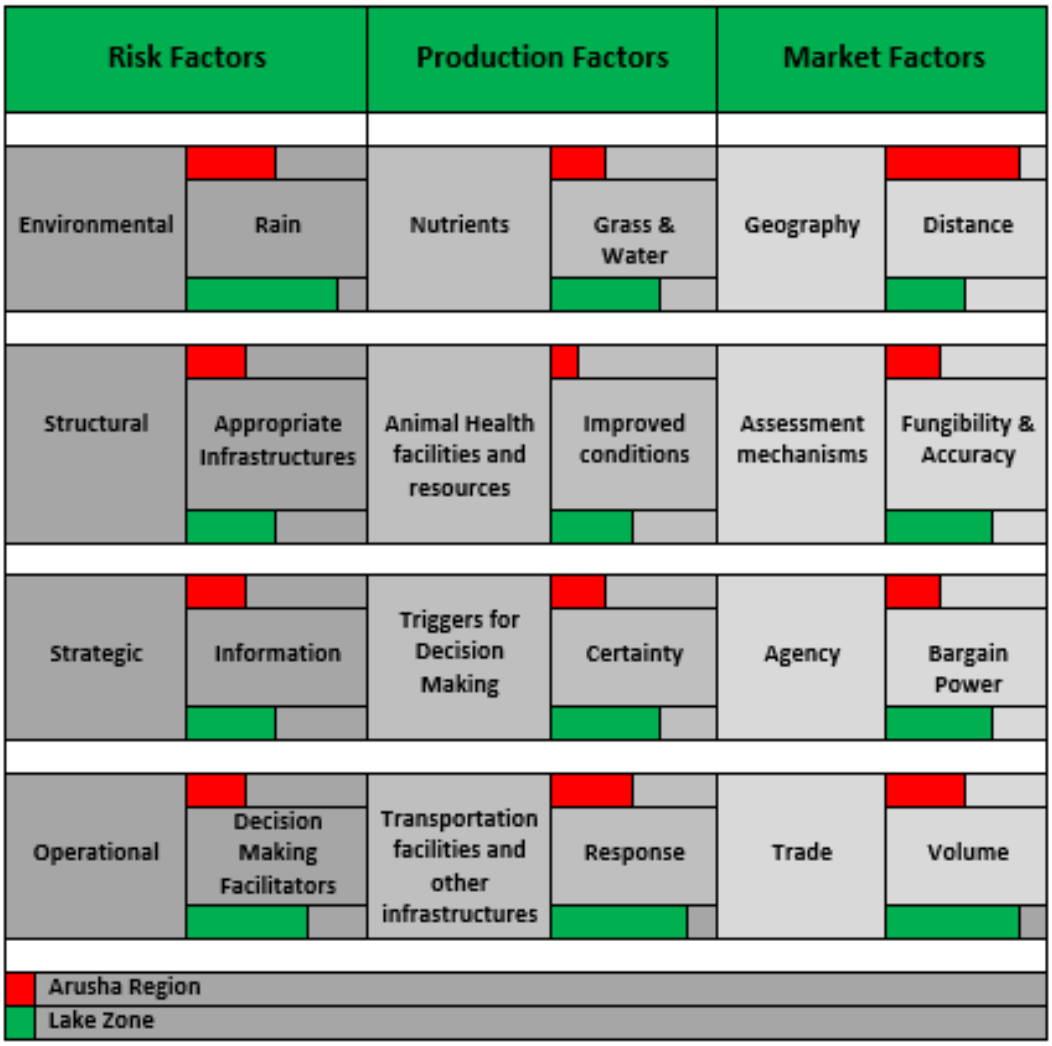

Table 13 - Table of factors influencing marketing and productions dynamics

Chapter 8 - *Appropriation* of mobile phones in production and marketing in Arusha and the Lake Zone

8.1. Introduction

In this chapter, the focus will be particularly upon the use of mobile phones and will include some examples of the appropriation of mobile phones for production and marketing in those two regions. I will look at routines such as transporting, relocating and negotiating the cattle at the market, and underline how the use of mobile phones is helping producers, and other actors involved, tackle the constraints and challenges inherent in production and marketing. As emphasised in the previous chapters, there are emphatic differences between the two regions regarding production strategies: we can accentuate a line of continuity (Jandreau & Berkes, 2016) in Arusha, or a more incremental innovation, whereas in the Lake Zone a more innovative behaviour, which emerges as more aligned with a sort of radical innovation.

The chapter will be split into two halves contrasting the two regions. Section 8.2. dedicated to Arusha, and section 8.3. to the Lake Zone. Each of those sections is constituted by 4 subsections, (8.2.1. – 8.2.4. & 8.3.1. – 8.3.4.) that will cover the same topics: **i)** managing risk and other factors influencing production; **ii)** coordinating movements and transportation to the market; **iii)** the use of mobile phones for negotiating cattle in the market, **iv)** and the appropriation of mobile phones in everyday life. In the section 8.4. I will proceed with my reflections and section 8.5. comprises the concluding remarks of the chapter.

8.2. Arusha Region

Livestock production in Arusha region has pastoralism as the main production process and is the characteristic trait of the Maasai. Permanent movement in search of natural resources to feed the herds typify this production method. The movements can be classified into two types: seasonal, according to the rainy season, and *ad-hoc* in the face of an event, such as an unexpected lack of rain, which will affect forage conditions. Movement is a key aspect of the life of the Maasai pastoralists, and their lifestyle is directly related to being nomadic.

That characteristic is a key factor impinging upon production dynamics, and in most circumstances, it brings negative effects on production, for instance the need to trek the cattle for miles searching for pastures, or to reach a market with good prices. This contributes significantly to decreasing the cattle's condition, which in the majority of times arrive at the market very light, due to lack of nutrients, but mainly of water, which leads to dehydration and loss of weight, and therefore not favouring negotiation over price. The nomadic lifestyle of Maasai exposes them to different sources of risk and danger. All those factors are now claimed to be better managed, mainly from the use of mobile phones to communicate and to search for critical information (Ngowi et al., 2015). During fieldwork, I saw all those factors interacting. A large majority of pastoralists interviewed explained that mobile phones are helping them, that the device is used as a resource to cope with the large periods of isolation that they are exposed to. In addition, they are better able to manage danger and hazards, and the mobile phone is critical to help them to face the challenges and exigencies of the livestock production in one of the most inhospitable regions of the country, the same is to say that they are becoming more resilient and able to self-righting after shock.

8.2.1. Mobile phones for managing risk and other factors influencing production

From a more agro-technical perspective, livestock production in Arusha can be characterised as an extensive mode of production, which will rely on time and space as the most important variables which can influence the production process. Handling those two variables requires good management skills in order to enhance productivity, this being very important for Maasai pastoralists because their production strategy requires an extensive use of those two variables. This explains how important is to exercise sound judgement before undertaking any journey with cattle, which explains why the mobile phone is so important for those actors. For instance, one group of actors we interviewed, the *herders*[85], said that the device is helping them to cope with

[85] The ones responsible exclusively to take care of the cattle amongst tribe members, during a given stage of their age set.

isolation and danger, and this allows them to better control those two factors by sharing critical information. For instance:

> *"[…] with the mobile phone, we can communicate with one another and inform where the good grass is and where not to go, because of the thieves or the military forces, and therefore increase our action."*
>
> **Interview with Timothy Oleyaile, WPC programme coordinator in Longido**

During fieldwork, I witnessed some of the transformations brought about by the mobile phone when it was used to tackle the lack of access to information during the long periods of trekking in the vast, and harsh, plains of Ngorongoro district, where the majority of the Maasai live. It is quite normal to see a Maasai pastoralist "apparently" lost in the middle of nowhere (see Chapter 3) trekking cattle. This image is misleading, because they say that they never have been lost, and that now they feel even more included, since they have a mobile phone.

The use of mobile phones is quite common among cattle keepers and this gives them a new perception of the time and the space dimension. The device helps them to bind those two together in a new, and flexible, dimension and enable them to be more self-reliant. However, if the use of the device is helping them on one hand, on the other hand the lack of infrastructure to support its use plays an adverse role. Lack of telecommunication signal and sources of power for recharging batteries are two big obstacles that they have to overcome and specific strategies are required to do so. For instance, the best strategies were described thus they:

i) *"always start the journey with the mobile phone fully charged and, at least, two batteries for situations when the journey is long, so they don't run out of power, and";*

ii) *"when there is an evident lack of signal that they switch off the mobile phone and just turn it on again in places where they know for sure that they will have signal strong enough to communicate critical information."*

Conversation not recorded, in my field notes

Another important aspect of the day to day lives of those pastoralists is trade, therefore, it is very important to have fast and flexible to access to market prices. Here too the incremental use of mobile phones has proved to be fundamental. Since marketing information is now more accessible, and since that information is an important element

of the decision-making process[86], this helps accuracy regarding when (time) and where (space) to go. These facts not only help to illustrate the *appropriation* process, but also to support the argument regarding the usefulness of mobile phones to leverage production and marketing in this region, making the activity more resilient. This is why the mobile phone is crucial for deciding when it is time to harvest the herd, which implies searching for best markets to sell the best animals. In the past, this used to be a major constraint because the best markets were, and still are, situated far from the regions where cattle keepers normally rear their herds. This is a major constraint, but now managed more easily through the mobile phone function. For instance, with was unanimous in this regions that to choose where to go and sell is now much easier: the mobile phone has:

> *"[…] simplified the way we do business and the way we reach the community. For instance, there are four* bomas *that are under my responsibility and in each of those* bomas *there are a mobile phone; so, we used it to communicate in case of someone have lost a cow or if there are business. Everything concerns the cattle we use the mobile phone to communicate. If there is new marketing (business opportunities) we use the mobile phone. This device has helped us a lot to conduct our business*."
>
> **Interview#50 - Saringe Rago - Laiboni of Maaloni Village – Waso**

This is an example of the ongoing *appropriation* of mobile phones, where the integration of that technology emerges closer to the users' needs, i.e. more user focused, and therefore explaining why it was so readily appropriated, a process that resembles the bottom-up perspective of technology adoption.

In concluding this subsection, the aim of which was to provide examples of mobile phone appropriation for production and marketing, it can be argued that the inclusion of that technology is creating conditions for those producers to be, as they describe, more involved, and indirectly contribute to the ongoing sociotechnical transformation of the livestock market. Therefore, this corresponds to one possible way to answer the research main question, namely the second half of that question, which asks *how the mobile phone is changing the way pastoralists interact in the livestock market?*

[86] See my Decision-Making Diagram in section 9.2.1.

8.2.2. Mobile phone for coordinating movement and transportation

In this section, I further analyse the *appropriation* process among the Maasai pastoralists by exemplifying the importance of mobile phones in other aspects of the livestock activity. I describe appropriation for a specific task (managing transportation), where the device is used to streamline a key operation that in some circumstances can involve up to 6 types of actors i.e.: producer, informant (*shushushu),* facilitator (*dalali*), transporter (*musuwagaji*), middlemen (*garagaja*) and the trader, all of whom depend on the mobile phone in their activities.

After the fattening stage, the Maasai will start to think about harvesting their herds, and this can be urgent depending on the rainy season and market demands, which will determine the strategy (retaining or releasing some cattle from the herd) and where efforts should be placed. This stage is frequently surrounded by many uncertainties and doubts, not only with regard to when is a good moment to sell, but, and tactically, which market to approach. This forces the Maasai producers to be judicious regarding their options and the strategy to relocate the animals to be sold. Dilemmas abound, mainly because markets with the best prices usually are far away, and resources, such as lorries, when available they are expensive, therefore not often used.

This frequently forces producers to trek the animals to market as a strategy to overcome that difficulty and to reduce costs. In this key stage of the marketing stage mobile phones are being used to mitigate the difficulties, which I can underline as another relevant aspect of the *appropriation* process. Fieldwork interviews revealed various strategies for moving the cattle from one region to another, with strategy changing according to the final destination, *i.e.* if trading is in a local market then trekking is the most frequent option, if in the secondary market, the option can, in some circumstances, be to use lorries as an alternative; nevertheless, each requires different approaches and the mobile phone is fundamental to simplify the process in both options, as pointed out:

> *"… after I have made sure that I have processed (negotiated) a certain number of animals I can always call the lorry man to come and collect the animals. So, the mobile phone makes the process easier."*
>
> **Interview#55 - Mr Maulid - Wasuwagaji - Mesarani MKT**

This evidence supports what was told to us by a large number of actors involved in the trade, namely that the device has been successfully integrated into the daily transportation activity, making faraway markets (and better prices) more accessible, and allowing for the transportation resources to be managed more efficiently. Those how did not respond affirmatively normally sell the cattle in a nearby markets.

8.2.2.1. Using mobile phones to manage issues of hazard and security

The example cited above is a particular case, of Mesarani market, one of the biggest secondary markets in the outskirts of Arusha city. There the lorry is the most used resource, mainly to take the cattle to the abattoir. That is in contrast to the usual practice in this region, where the classic movement of animals to market is by trekking, with many dangers. Producers claim that their difficulties increase if one or more animal is lost during any of the stages of production or marketing, and this has always been a part of livestock keeping dilemmas in this region. It is traditional among the Maasai to have a special way to communicate loss. In the past, this used to be done in a traditional way using a special horn:

> *"[…] if someone lose some cattle we used to use a special sound (horn) to inform that. So, if someone hears that sound they will know exactly what it means […] or if someone has been robbed we used another specific sound to communicate. There are special sounds that we use for when the cattle are lost or robbed or for when there is a war.*
>
> **Interview#50 - Saringe Rago - Laiboni of Maaloni Village – Waso**

Nowadays the mobile phone gives the Maasai the chance to communicate such events more efficiently and quickly and thereby increasing the chance of recovering lost animals, or of preparing a specific action more quickly, as described below:

> *"Recently my herder lost 10 cattle. He phoned me from the bush informing me about that. I asked him to describe the lost animals, and from here, I phoned to some other pastoralists in my region asking them if they have found the animals. One of them told me yes; I phoned back to my herder and told him where he should go to recover the lost animals. Today he phoned me telling that he has all of them. Without the mobile, I would have definitely lost these cattle, and that is something that I cannot afford. I have only 100 heads."*
>
> **Interview with Timothy Oleyaile, WPC programme coordinator for Longido**

8.2.3. Mobile phone for negotiation

Before I describe my empirical data in this section I want to emphasise an understanding that I suggest is emerging from my data analysis so far. From observation and interviews, it is clear that mobile phone technology is perceived by the Maasai as an 'artefact' with a symbolic presence (*what does this mean to me*), and by the Wasukuma as a 'tool' with an instrumental presence (*what can I do with this*). Nevertheless, in both cases the technology is used to help simplify tasks inherent to production and marketing stages in both regions.

Focusing now on negotiation, the Maasai have a clear notion of the change brought about by the mobile phones, and even though the technology is not challenging their way of life, *i.e.* it is not disrupting some conservative practices, they emphasize that they have improved substantially the way they do things by using the artefact. However, mobile introduction has not been a straightforward process, since there are some infrastructural limitations, such as too few communication towers to allow permanent access to sources of information. Such limitations may affect negotiation because other participants may have better connectivity. This was frequently pointed out to us, being visible that the device is still fundamental, for instance when helping them:

> *"[…] to know the prices for cattle in nearby and faraway markets. This is what I use the mobile phone for [...]."*
>
> ***Interview#49 Easter Jakob***

It is almost undisputed that the device has helped better negotiate the cattle price, thus tackling chronic issues such as the lack of market information, and this is helping pastoralists to increase profit:

> *"The use of mobile phones nowadays is very, very important, because now we can get more profit when we sell the animals, because we have already communicated through these mobile phones [to make arrangements]. So, we need them a lot."*
>
> ***Interview #48 - Raphael Manangoi***

However, as described above, there are limitations. The benefits of possessing a mobile phone is not beneficial only to the Maasai producers. There are the counterparts (middlemen and buyers) also using it, and in this particular case some Maasai

producers claim that this creates even more fragilities for them. When investigating, I discovered that the claim that the device seems to work better (operability) for some and not for others is related to access to better infrastructures (network coverage) supporting the normal functionality of the mobile phone. It is easier for middlemen to *linkup* (H. A. Horst & D. Miller, 2006) with agents in key urban centres than for the pastoralists to set up connection between themselves at the local level, and this creates disparities, which will favour the middlemen because they have access to more information, as pointed out by this trader:

> *"when I need some information, I call someone here in Dar es Salaam, and ask information about the price."*

Interview#20 - Charles Kasuka

That group of actors is obtaining more benefit from the mobile phone and infrastructure, when gaining access to privileged information circulating in urban areas and using this information to introduce some opacity and unfairness when dealing with keepers in the primary markets in remote regions. The premise is that the pastoralist, unable to get access to updated information and to reach far away markets, will have to sell in local markets where the supply is high, and consequently the price is low which favours intermediaries. Those normally buy all the cattle in those local markets and wait for the price to rise before reselling in secondary markets near urban centres at inflated prices. This was emphasized by several traders and pointed out by a middleman as being a strategy, underlining that they contact:

> *"[…] friends from very far, for example from Shinyanga, and ask the number of animals in that market, and automatically [they] will know if the number arriving at this market will be small and if the price will be high, so normally [they] buy and wait for the buyers to come and buy [from them]."*

Interview#54 - Mr Mollel - Maasai trader - Mesarani MKT

It is to try and tackle that particular aspect that they point to the mobile phone as being their ally, because with more access to price information, they will be able to increase their options, and have more elements to support their activities around demand, assisting their critical decisions such as go or not to go to a distant market. i.e.:

> *"[…] for the markets, more distant we use the mobile phones to communicate to search for information [and decide to go or not]."*

Interview #48 - Raphael Manangoi

Therefore, the appropriation of the mobile phone amongst producers to resolve obstacles to better negotiation changes the dynamics of the livestock sector when it gives producers more options to negotiate. However, as said, this new dynamic is not taking place as planned by the government when they implemented LINKS, (which relies on the *SMS* to disseminate official information). Even amongst the minority who are aware of its existence, cattle producers cannot use LINKS to get market information because in the majority of circumstances it is not available. It seems there is no space for LINKS in trade dynamics in this region.

I would say that the mismatch of interpretation regarding the usefulness of the sociotechnical arena is evident and expressed directly in the fact that the users rarely interpret LINKS as working for them or in their favour. Instead, the mobile phone is giving them flexible access to the network of friends and family (informal[87] network of information), which is prevailing as the main source of market information. Concluding, it can be said that the appropriation of mobile phones amongst those producers continues at a positive pace and is an optimistic fact that emerges as the core of my argument as it supports a perspective similar to what I can claim to be a bottom-up adoption process. The integration of that technology, as an enabler, is the result of those actors attempting to make sense *(what this mean to me*) of that technology, and taming it, in order to solve particular problems in their daily lives, which consequently is improving the ability to negotiate, and therefore is helping them to prevent an unfair game that have been prevailing for decades, and this sits comfortably in the rationale supporting the resilience approach.

8.2.3.1. The Mobile phone as an enabler

The above conclusion leads to the assertion that certainty is critical to any market. Nowadays for the Maasai it is not only a good rainy season that brings certainty, but also fast and permanent access to information enabled by mobile phones. Producers claim that having new ways to find and disseminate trustworthy information is helping them to acquire more certainty, for instance when deciding if it is worthwhile making

[87] See the Decision-Making diagram in section 9.2.1.

a long-distance journey with the guarantee that they will obtain a good price for a set of animals to be sold in a given market. In this scenario, the mobile phone emerges as the enabler of those new possibilities, not only in searching for grazing areas, and water, but also the option to search specifically for marketing information and best markets with good prices. This latter option is enabling those actors to make use of the new agency (the power to bargain) to negotiate a fair price. This is another aspect which is helping to answer my main research question, because they claim that:

> "[…] *this device took us from the 17th century and brought us directly into the 21st century."*
>
> **Interview with Timothy Oleyaile, WPC programme coordinator in Longido**

This claim, and all the evidence produced so far, provides solid grounds for asserting that the mobile phone is emerging as an enabling technology. Some of its functions are enhancing the possibilities for all the actors involved in this production and marketing chain to cope with constraints of different kinds and intensity, but mainly for the Maasai pastoralists who are more exposed to those constraints, and these empirical facts support the resilience perspective I introduced in chapter 4, namely the arguments of Prilleltensky when suggesting that those constraints are preventing them "from exercising or experiencing self-determination, distributive justice, and collaborative and democratic participation" (Prilleltensky, 1994, p. 359). Consequently, production processes emerge as easier to manage, and in some particular situations, the device is disrupting the way in which key processes are undertaken, for instance the communication of loss. This was, and still is, an important aspect of the Maasai culture, but it is now revolutionised by this technology, which as an accessible and generic communication medium makes it easy:

> *[…] to send and receive messages, and anybody can do it."*
>
> **Interview#51- Lucas Mwalongo**

Those facts are illustrative of the *appropriation* process when enabling producers to make practical decisions and implement them. The ongoing process of appropriation and incorporation of mobile phones in production processes has enhanced the possibilities for production with more quality, for transport with more security and

speed, for trade with more certainty and fairness, and the most important for the Maasai, to enlarge their herds, as this short dialogue illustrates:

> *P1/A – If someone has a problem they can phone you to inform, and you can go there and buy and then sell, keeping some of them to add to your herd.*
>
> *R/Q – So, we can conclude that with the mobile phones it is now much easier to run pastoralism and control all the situations.*
>
> *P1&2 – Yes (both agree).*
>
> **Interview#5 - Philémon Olé Saipi and Masige Shomi (pastoralist-middlemen)**

Supported by those arguments, we can point out that the recurrent use of mobile phones for negotiation is indirectly enabling the sociotechnical arena. Data are being produced that can be useful for understanding trends, frequency and quantity, which can make it possible to build faster and efficient linkages between demand and supply, and thus balancing existing power relations within the livestock market. This is one more aspect supporting my idea of the co-construction of the livestock market, which is being reshaped by the use of mobile phone, mainly when giving those actors the possibility to bind time-space. This is making them not to feel isolated from the social world, and gradually changing some of the routines and cycles of livestock production making it more resilient, as pointed out by the Laiboni of Maaloni village, who has the authority to speak on behalf of the community:

> *"We have accepted the change brought by this technology, and even within the community they are feeling safe if the mobile phone is there, simply to have the possibility to communicate"*
>
> **Interview#50 - Saringe Rago - Laiboni of Maaloni Village – Waso**

As I have been arguing, the mobile phone emerges as the technology supporting this sociotechnical transformation, because the device has been backing-up some of the most important production and marketing decisions. This allows the Maasai to selectively harvest the herd and supports other key decisions. The technology is associated with those new possibilities because its main function is helping producers to receive and disseminate information that can help to anticipate negative production factors and prevent risk factors that in the past when not managed properly would cause a disaster. Evidence shows that all those constraints have been moderated with the support of the mobile phone, which is helping these people to enhance their resilient character, as suggested below:

> *"The mobile phones have helped us a lot. First of all, being livestock keepers and having to graze the animals our* bomas *and the family will be very scattered. When we have a ceremony, or just to transfer some messages to another* boma *or family, usually we used to use a middle way, or we used to send a young man to take that message; but now the mobile phone has enabled us to communicate faster. So, we use the mobile phone in particular to communicate an issue and not having to travel a long distance to deliver that message, but the use of mobiles phones is not changing our way of living."*
>
> ***Interview#50 - Saringe Rago - Laiboni of Maaloni Village – Waso***

Rather than changing their way of life, the mobile phone is improving it and strengthening the culture of those pastoralists. The transformative capacity of this medium is acknowledged by users, designers and policy makers, and in many other areas of action within the livestock market, as enabling these changes. The mobile phone has changed the way pastoralists live, and how they interact with the livestock market when reshaping some of the stages of production and marketing. This is one side of the *appropriation* process. The other, which is not the central aspect of the research, will be covered briefly in the next section because it represents the realm of the appropriation process, *i.e.* how the device is being used in everyday life.

8.2.4. Mobile phone appropriation in everyday life

So far, I have been pointing to the use of mobile phones specifically in respect of herd management namely production and marketing. However, and even though the examples explored so far help understanding of the *appropriation* process for managing marketing and production, the mobile phone increases the realm of possibilities in other domains. Using the mobile phone to manage the herd can be described as just the tip of the iceberg, whilst the real use and process of appropriation is like the invisible portion of the iceberg and comprises the level of the micro-coordination of household affairs, which offers an opportunity for another research project. My findings about this topic emerged collaterally during the data collection process. When asking actors what they use the mobile phone for besides supporting livestock management, their answers made it clear that there is a variety of situations where the mobile phone is used, and they are largely related to the micro-coordination of the household. For instance, my data suggests that a minority of daily mobile phone contacts are made in order to sort out issues of livestock. The majority of the matters

are related to family matters. As a consequence, this helps bind and strengthen family ties, as expressively pointed out by the participants and illustrated by the only woman pastoralist (and head of the family) I had the chance to speak to:

> *"my mobile phone is very important to me; I am not happy when I see someone without a mobile phone. The mobile phone is very, very important for my business, for my activities, for my family, [mainly] to send money."*

Interview 49 Easter Jakob

The last activity mentioned, referring to sending and receiving money through M-Pesa, is one of the most notable trends when looking at the variety of options and situations which the mobile phone has introduced in everyday life. This is notwithstanding some obstacles such as tariffs for voice and data communication, which are dealt with through vouchers or airtime bundles made available by mobile communication operators, and which have expanded this communication option to a large fringe of the population, as pointed out by the same participant:

> *"[…] I use the voucher [pre-paid cards to top up the handset], sometimes there are some reductions from Airtel [one of the main operators].*

Interview#49 Easter Jakob

This corresponds to a generalised practice amongst users I interviewed, which has underlined the cost of airtime as one of the main difficulties. Together with the lack of signal which prevents them from using the mobile phone more often, or adequately, in order to derive more benefits from the windows of opportunity that the device is opening. Evidence also showed that the mobile phone is now a part of people's home appliances and works as an extension of that environment: wherever they are, their home and family will be there with them. This is one of the radical transformations resulting from the *appropriation* process. The use of mobile phones and its inclusion in the activities of daily life, therefore is a relevant aspect in the Arusha region, where communication has always been an important aspect of the Maasai culture. In some ways, there is a sort of disruption of longstanding practices, which emerges as a direct consequence of the accessibility, autonomy and coordination that the device permits. For instance, there are some gender issues that have been highlighted by this medium, as some women seem now to have been empowered to make decisions which they could not do in the past. Decision-making within this society normally is a male prerogative. This Maasai widow told us her story, emphasizing that:

"I was not deciding anything when my husband was alive; now I feel very happy to take the decisions for my family, mainly because a lot of things have changed [for instance] now I have a mobile phone and I use it to communicate with [my children] that are far from home studying […]. Besides that, I use it mainly for business purpose; to send information and receive information, or if someone is sick at home or faraway we use the phone to communicate.

Interview#49 Easter Jakob

This empowerment of women now extends to the level of surveillance of the partners' activities outside the household. This is reinforcing their role in coordinating the household as it is helping them to manage sensitive family issues and to force the partners/husbands to face the consequences. That is the mobile phone is also allowing those women to be:

"more vigilant of man extra matrimonial activities."

Interview with Timothy Oleyaile, WPC programme coordinator in Longido

A significant number of participants interviewed in both regions mentioned the above to us. Nevertheless, it is mainly in managing ordinary matters such as greeting messages, sending or receiving remittances, or trying to solve urgent matters related to a family member's sickness that the device reveals its usefulness. These matters represent the top three of those that the mobile phone is used for, as pointed out by this other pastoralist and head of the house we spoke to in Sale – Ngorongoro Division:

"[I use it first], to greeting early in the morning with my family, the second is to find out about the cattle price and the third is to send money […], the mobile phone is very important to me. Let me tell you two days ago I used this mobile phone[88] to send money to a relative that was very sick in Arusha […]. As said earlier the mobile phone is very important to me. If we compare a few years back and nowadays it is very different, for instance few years back if we needed to send money to Arusha we would need to use the motorcycles to go there, but nowadays we can just use the mobile phone to send money, or to send greetings to our relatives, it is a big difference. Life is much better now comparing with few years back when we did not have the mobile phones.

Interview #48 - Raphael Manangoi

Evidence has further shown that the mobile phone is typically appropriate in relatively 'conservative' ways to micro coordinate household affairs, and not disrupt some strongly grounded cultural and social practices, even though is already suggesting

[88] My interviewee showed me proudly the mobile phone as part of his garment.

some interesting changes of power and agency, which is generating some levels of dependence as suggested below:

R/Q – If you don't take your mobile phone with you how does this affect you?

P/A – I would feel very bad.

R/Q – what is to feel bad?

P/A – I feel bad because the communication with everybody would be cut off, it is like that someone is cutting my hands.

Interview#54 - Mr Mollel

Nevertheless, and notwithstanding those levels of penetration and use, there are still some other constraints to be overcome in this region, among them the lack of purchasing power to buy a mobile phone and to keep it operating. In this particular aspect, some strategies were put in place to tackle those difficulties which are preventing communities (clan or *bomas),* to have access to the easy way of communicating and solving family issues. The Laiboni of Maaloni village, which has a few *bomas* under his responsibility, explained that:

"there are different ways of solving that. For instance, if the boma *cannot afford to have one mobile phone then we will try to make sure that they will have at least one chip [SIM card], or if they cannot afford even the chip they can go to the Laiboni, held him some money for credit, and use his mobile phone to call someone. But there is no official way of doing this, it could be by fundraising among other members of the community so this* boma *can have a mobile phone, or it may happen automatically, if there is one problem to be solved."*

Interview#50 - Saringe Rago - Laiboni of Maaloni Village – Waso

The above quote depicts some of the strategies used by this local leader to help his community to be communicatively accessible. Nevertheless, as noted, the levels of penetration and use are very consistent amongst users in this region, and the real use goes further than just for livestock management. To sum-up, section 2 of this chapter has helped to highlight key production factors and aspects of the day to day life of the actors inhabiting Arusha region that were positively reshaped by the mobile phone. It was noted that the device, as an accessible and generic communication medium, was very readily appropriated not only for purposes of herd management but also to manage household affairs. I now move to section 3 using the same structure to describe the *appropriation* process in the Lake Zone.

8.3. The Lake Zone

I will now seek to describe how the mobile phone has been appropriated in the Lake Zone for the same purposes and shed light on the incorporation of the device in the day to day life of producers there. In the first section of this chapter, I indicated that there are some constraints – environmental crisis and political and economic factors – that force the Maasai producer to undertake long journeys searching for pastures. This is important because this constraint is not as overwhelming in the Lake Zone. In the Lake Zone, there is an interplay of factors (environmental, cultural and structural) comprising and supporting the livestock activity, making the mobile phone less relevant to production than in Arusha region. Notwithstanding, the *appropriation* process in the Lake Zone favours some important variables which accentuate the contrast when comparing the two regions.

The device is not so relevant at the production stage in this region as in Arusha but is key at the marketing phase. For instance, there are two outstanding factors that I have identified as relevant strategies supporting livestock production in this region. The first is at the level of local and tacit knowledge, which allows for better management of natural resources, and does not require the producers to relocate too far to feed their herds. The second aspect, at the structural level, is the alternative strategy used to feed the herd which helps the producers to improve the cattle's condition, i.e.:

i) the *Ngitili*: which determines the rotation of the cattle in-between reserved grazing areas;

ii) and the feedlotting scheme, where the surplus resulting from seasonal crops (mainly maize) is used to complement feeding of the herd in those places.

In contrast to Arusha, the production strategy in this region relies substantially on those two factors, and consequently lowers the need to be as mobile as in Arusha. Therefore, the mobile phone is not as relevant as it is amongst the Maasai pastoralists, who are forced to make long journeys to search for pastures and water.

The above is significant because it creates a disproportionality in the data collected from the two regions concerning mobile use. For instance, in respect of the marketing

process, the mobile phone emerges as very important in this region, mainly in linking the producers with the middlemen or with the facilitator (*dalali*), thus making a larger amount of information available in comparison to Arusha.

The argument of section 3 of this chapter will be based on relevant material collected in key markets in the Lake Zone, which will help to describe how the flux of cattle flows from the last stage of productions (fattening) to marketing and then to the next stage of transformation (slaughtering). The voices of the producers and agents will show how mobile phones are used to better manage the impacts of moving the cattle. More specifically, they will show how the *wasuwagaji* (trekker), with recourse to mobile phones, manage issues of hazard and security when trekking cattle to market. Later I will discuss, in subsection 8.3.4., the appropriation of mobile phones in everyday life, and illustrate how those actors' micro-coordinate matters to do with their household affairs when far from home during the periods of trekking.

8.3.1. Mobile phone to manage risk and other factors influencing production

As already described, agro-pastoralism constitutes the main production strategy in this region, and the management of land is carried out largely through what the people call modern *Ngitili*, which decreases dependence on land extension for animal production, typical in the extensive regimes of livestock production. This results also from better quality of natural resources (more rain and pastures) and to a larger cluster of sociotechnical infrastructures, makes producers less liable to having to move so often and therefore not dependent so much on the need to be permanently in communication.

In this region, the device is predominantly used at the marketing stage, in contrast to Arusha where the use is heaviest at the production stage. This usage gives the producers in the Lake Zone more alternatives to negotiate and to make arrangements to relocate or transport cattle to market to be sold. This is mostly done by the intermediaries on behalf (and absence) of the producer, which constitutes another particular aspect (improvement of the relationships between producers, intermediaries and the *dalali*) where some of the mobile phone functions are better used in comparison with Arusha, therefore making the marketing process more efficient.

The narrative of appropriation and use of mobile phones in this region places livestock production into an industrial context, where the presence of multiple activities such as fishery, mining and cotton, act as anchors of support. Mobile communications emerge here as a substructure embedded in all those sectors of activity, indirectly favouring conditions for the livestock sector to develop. Therefore, there are grounds to maintain that, in contrast to Arusha, the mobile phone *appropriation* process in the Lake Zone does not occur as it is in Arusha and amongst the Maasai; the *appropriation* is more a sort of technical inclusion, responding to the objective purposes. For instance, people in this region are more used to searching for technical information or directives using complementary alternatives such as newspapers or the radio, because that information appears in those media more frequently. This was suggested by some of the actors interviewed:

"[…] sometimes they broadcast the information, and we listen to the radio"

Interview#26 - Kashinje Tungu

This creates the notion of an ecology of ICT, where the mobile phone emerges as a component of a large sociotechnical assemblage. All those structures, substructures and dynamics, make the mobile phone less visible, and emphasises the sociotechnical assemblage existing in this region, which puts the Lake Zone much closer to the transformation envisaged by the LINKS programme.

8.3.2. Mobile phone to coordinate movements and transportation

At this stage, I have shown that the production methods in Lake Zone are more effective in producing higher quality cattle for market. The majority of cattle sold in the final market (Pugu) are from Lake Zone. This, makes it indispensable to use motorised transport to ship cattle to DSM, as underlined by the Zoo Sanitarian Inspector of Pugu market, Mr Shasha, when emphasizing that the majority of the cattle traded in this market are from:

"[…] Shinyanga, Kahama, Mwanza, Singida, Tabora, Kagera, which is western Tanzania (i.e. Lake Zone).

R/Q – and which one is option they use to bring the cattle to this market?

P/A – Road way, they use big lorries. Railway is not operating nowadays, but once it was the major source of income.

R/Q – there are animals arriving at this market by trekking?

P/A – No."

Interview19 - Mr. Shasha, Zoo Sanitarian Inspector at Pugu

Coordinating this process requires some effort of synchronisation and it is in backing up this operation that the use of mobile phones is pointed to as an important technology, mainly when enabling the communication amongst all players involved in the operation, and thus making it possible for instance to use the full capacity of the lorries, and:

"[…] the best solution is to collect the cattle first and then you make the contact with the driver or, you can make the contact with the dalali, *[and] they will make the transportation from there until the destination.*

Interview22 – Group interview at Pugu Market

In this network of players, one actor emerges as central, the *dalali.* He is the one holding the information and resources (mobile phones and contact numbers of lorry drivers) to coordinate and speed up that process, which will eventually generate better income for all the parties involved, because the animals will arrive more quickly and in better condition at the final market. This coordination and synchronisation are very important because what determines the:

"final price is how they transport the animals. So even if I have access to that information (LINKS) I still have to deal with the transport issue."

Interview#26 - Kashinje Tungu

This is a crucial role mainly because the coordination of transport normally involves different strategies to collect and distribute the animals according to their origin and destination: if the destination is Pugu then the option will be, almost certainly, by lorry; whereas if the destination is a local market (primary to primary market or primary to secondary market) then the transportation will be done primarily by trekking, and alternatively by lorry. The *dalali* is fundamental to operationalize that process as confirmed in the following quote:

P/A – Yes, I am responsible to contact the drivers that drive the lorry from one to another compound.

Interview#55 - Mr Maulid – Dalali

Therefore, the *dalali* will help to set up the best option, which will depend on the location of the market. This creates a differentiation amongst the typology of the acting *dalali*. There are *dalali* that act only at the inter-markets level, the ones who are expert in finding the *wasuwagaji,* and there are the others that just operate in the final stage of the process, *i.e.* sending cattle to the abattoir, as pointed out by the same *dalali*:

P/A – I just organize transport for the animals from here to the abattoirs.

R/Q – And how do you transport the animals from here to the abattoir, trekking or by lorry?

P/A – Lorry.

R/Q – How many animals do you take normally?

P/A – Depends on the capacity of the lorry, for instance, here we use the big lorries, and they can carry around 38 animals.

Interview#55 - Mr Maulid – Dalali

Those *dalalis* are the ones that dictate the pace and accelerate the flow of information and expedite the different tasks involved in moving and transporting cattle inter-market and to the abattoir. They are very specific actors, and it is almost impossible not to have contact with them if transport is needed. They are in almost all the big markets, and they have some particularities that identify them as a *dalali:* they always carry a small jotter and a pencil, and normally more than one mobile phone as indispensable tools, in order to respond to any pressing matter, as suggested below:

R/Q – Which would be the major difficulty or constraint that you would be experiencing in doing your business without using the mobile phone?

P/A – You know some problems may occur on the way to the abattoir, for instance our cattle, the local Zebu, they are very furious[89] *and sometimes they can jump from the lorry. So, in this case how can you contact the owner of that animal and inform him that the animal has jumped and disappeared? So, if you have the mobile phone you will phone him directly and say: '*Mr your bull with the big horn has now disappeared, please come and help me'. *Without the phone, I cannot do that.*

Interview#55 - Mr Maulid – Dalali

The above example helps to outline one amongst many situations where the mobile phone is used to manage the need to quickly respond to an event and to handle

[89] When enclosed in the lorries those animals sometimes become much stressed and react in unexpected ways.

awkward and dangerous situations such as the ones faced by the *wasuwagaji* during the trekking, which is occurs mainly during the night. Some of the situations have their funny side, such as the one described by Mr Maulid, but there are others, which are hazardous, and where the threat is real such as having to face wild animals or thieves when trekking cattle during the night. All the interviewees were unanimous in claiming that the mobile phone has created many options for dealing with those particular circumstances, mainly the ones occurring at night, where the device has enhanced the possibility to act fast and with efficacy. Now there is more likelihood of having communication with the *dalali* or with the cattle owner to update them of any occurrence, or just to search for business opportunities, but the most important seems to be to report any strange situation occurring during trekking, as we will illustrate below in section 8.3.2.2.

However, before that it is important to explore the reasons for the need to permanently speed up the transportation. According to the Pugu Zoo Sanitarian Inspector, there is one particular rule prevailing concerning the typology and classification of animals to be sold in Pugu, determining that the cattle to be sold in this market should be Tanzania Special and/or grade 1 or 2. Animals with grade 3 normally are not traded; they can only be exchanged and included in the fattening cycle and later returned to the market to be sold for beef meat production. This process seems not being the reality and many animals with inferior grades are found in Pugu due to the lack of resources to ensure an efficient transportation of cattle to the main market:

> *"The majority of the animals are grade 2 and 3 due to long trekking and harsh travel conditions. […]. But there are two problems, the hurry in meeting the demand of market; and second the courier (lorry man) cannot allow himself to expend more than a given time waiting, otherwise waiting charges should be included; which means that if the farmer cannot afford, and the courier cannot allow the vehicle to expend more time on transit, they should go faster and collect other cows for business."*
>
> **Interview19 - Mr Shasha, Zoo Sanitarian Inspector at Pugu**

The need to respond quickly to demand is pushing producers to rapidly ship cattle to Pugu. However, due to the need to reduce transportation cost this is not always done as it should be, animals are transported in poor condition (lorries normally arrive at Pugu overloaded) and the rest time, to rebuild condition, is not respected, which makes the main rule (cattle sold in Pugu must have categories 1 and 2) not being regularly

observed. This is important to highlight because the use of mobile phone is helping all the actors to minimize negative impacts in the cattle, and make the process more efficient, mainly when helping to find transport at an affordable price.

Another important aspect to underline is that it is Pugu market to which all the producers, if possible, would prefer to send or take their animals to trade. They know that the profit will increase substantially if they avoid intermediaries and agents, such as the *garagaja* (middlemen), and go directly to the end of the chain. However, that option is not available to them all, because transportation usually requires the intervention of a third party (*dalali*) who normally works directly with the *garagaja*, and the majority of the producers and traders cannot afford to hire a lorry by themselves. For instance, in Pugu market we spoke with one trader from Dodoma, where the central holding ground (Kizota) is based, and we asked him what the major difficulties in sending the cattle to Pugu and the answer was:

> *P/A – […] transportation and capital (money). Because when you are in Dodoma you will have to hire a lorry to bring the cattle. If the capital is short, you will have to share with other stakeholders to make contribution in order to make transportation from Dodoma to Pugu cheaper [and] we do it through the* dalali *that contact others in order to arrange contributions. He contacts one man and another from different locations in order to contribute for the transportation.*
>
> **Interview20 - Charles Kasuka\\Interview#20**

The mobile phone is revealed as an important tool to help manage lorry capacity and handle waiting times, and this was pointed out as crucial, mainly when supporting the interplay between the *dalali* – producer – lorry man – *wasuwagaji* – to facilitate the operation. Therefore, the mobile phone emerges as enabling and facilitating the coordination of transport, which favours the cattle condition to remain good, an important factor at the marketing stage. The efficiency and speed of communication that the device allows improves conditions for reducing transport costs and increasing the quality of cattle arriving at Pugu. Therefore, that factor, that used to be a key constraint for producers in this region, seems to have been mitigated by the *dalali* action, mainly when making use of the mobile phone, because it gives them the possibility to enhance coordination through the flexibility that it allows. As noted earlier, cattle found in Pugu come from different regions, but mainly from the Lake

Zone, and they normally are shipped via Dodoma in a very coordinated action, and pointing out to the booking process as emphasized by Mr Kasuka:

> *P/A – […] the thing is that there are ways of making a booking. […] Sometimes you go there, and you say:* 'I have a certain number of livestock', *he (*dalali*) records and connects with another* dalali *to make this clear.*
>
> *R/Q – So, the* dalali *is the one who keeps the information about the people who have cattle to bring to Pugu. He registers all of them and then he will contact all of them to take the cattle.*
>
> *P/A – Yes, the* dalali *in certain villages or situations can call other two or three different agents or traders to fill the lorry.*
>
> *R/Q – So the* dalali *will be collecting information from this one and that one and putting all together until we can say ok now we have enough cattle to take to Pugu […]*
>
> *P/A – You will not see the other stakeholders but the* dalali *will connect you with them. He always knows someone that has someone's cattle to transport, so he himself makes connections and bookings, and contacts others and says this transport needs to go there.*
>
> *R/Q – How do you contact the* dalali *normally?*
>
> *P/A – I have his mobile phone number; I have his number in my phone. If they are coming from Shinyanga or somewhere, you will have to call him and then he makes the booking himself.*
>
> **Interview20 - Charles Kasuka\\Interview#20**

Normally, one will see the trader and the agent busy interacting face-to-face with the *dalali* to ensure that the transportation of their cattle to Pugu will be done and that they will have priority. Contacts are made normally via Dodoma[90] and then the links are set from there to Arusha and the Lake Zone, and this is done with a good level of coordination, and it is more surprising because it is not an official or formal arrangement: this is just people using the mobile phone to sort things out.

8.3.2.2. Using mobile phones to manage issues of hazard and security

In this section, I focus on the local level, i.e. the primary market context, where trekking is the most common method used to move the cattle from one place to another

[90] Dodoma used to be traditionally a central point of connection of different routes for the transport of cattle and other goods. It is here that the central holding ground is based (Kizota), and very little trade is done. Cattle normally are just kept there to rest and regain condition before being sent to the abattoir or transported to Pugu.

and the *wasuwagaji* (trekker) is the actor to whom this task is assigned. He is the one in charge of relocating the cattle in journeys that sometimes can take several days[91], as the short dialogue aims to illustrate:

R/Q – When transporting animals from one place to another, do you trek, or do you use any other option?

P/A – I only trek.

R/Q – How long it took your longest trek?

P/A – three days!

Interview#37 - Ndebile Ngese – Musuwagaji

In this context, again, the *dalali* and the *garagaja* coordinate the operations making use of the mobile phone to make permanent contact with all the actors involved in the trade and coordinate the movement of the cattle, mainly with the *wasuwagaji* who will trek the cattle. Those *dalali* are at the centre of the operations, as suggested by this *musuwagaji* I interviewed in Senani:

R/Q – Normally how do you get involved in transporting animals, it is you contacting the middlemen or the trader, or normally do you receive the contact from them?

P/A – I receive the cattle from the garagaja *with instructions to which market I should take the cattle.*

R/Q – And how does the garagaja contact you?

P/A – He uses the mobile phone to contact me.

Interview#36 - Mboje Lukumanya - Musuwagaji - Senani MKT

Field observations showed that in this context the *wasuwagaji* are, probably, one of the most important elements amongst all the participants in this trading network, notwithstanding being placed at the lower level of the hierarchy of the actors participating in the trade process. Interviews revealed claims suggesting that the system of reward is not fair. For the *wasuwagaji* the weight of the responsibility is not proportional to the benefit they take from their activity. The sense of unfairness and risk emerges as larger for them than for any of the other participants, mainly because the price they receive per head of cattle delivered is much smaller than the price they

[91] Large periods of them undertaken at night

have to pay if they lose an animal; and it is proportionately even larger if we consider that the average prices for animals of category 2 or 1 will vary between 400,000TZS (Tanzanian Shillings) (£130) and 700,000 TZS (£227). This keeps on pushing the *wasuwagaji* to the lowest position in the hierarchy regarding the way the trade revenue is shared between all participants. It was frequently pointed out that their work should be worth more than the amount they receive per head of cattle delivered, which is very small, as illustrated in this quote:

R/Q – and how much do you receive normally per head of cattle you have transported from one place to another?

P/A – It is 1 000 TZS (£0.32*) per head.*

Interview#36 - Mboje Lukumanya – Musuwagaji, Senani MKT

With regards to the above price, I collected further information and found out that the price will vary, and that it could reach 15,000 TZS per head according to the circumstances. However, the system in place seems not to be rewarding them as much as they believe they deserve, considering that the *wasuwagaji* are key players in the set of actors supporting the trade. They emerge as the operational side of the marketing stage that works in the background to ensure that the movement of the cattle is done with as little impact as possible on the herd, and safeguarding that:

i) the cattle will arrive at the market, and
ii) that they will arrive in the best visual condition possible, as this influences the assessment, the bargaining power and consequently the final price.

Nevertheless, these actors are exposed to a number of factors that generate a huge degree of insecurity and a high-risk incidence. Loss, theft, and threats to personal security are among the factors exposing the *wasuwagaji* to vulnerability. As we were able to evidence, the increased use of mobile phones within the livestock trade enables the *wasuwagaji* to better manage some of the risk factors inherent to the nature of their activity, especially when trekking during the night:

"R/Q – When you trek the animals for a long period, such as three days, what is the strategy, do you do it during the day, do you stop, and do you sleep over the night. How do you do it?

P/A – Both, I trek during the night and the day.

R/Q – And when is the critical moment, during the day or night?

P/A – Night

R/Q – And why?

P/A – During the night, because there are some dangerous animals, for instance hyenas.

Interview#38 Sita Gagala

The device is giving those actors the opportunity to tackle those dangerous situations and to be more frequently present during negotiation, because trade will always imply the need to relocate cattle. The next quote aims to illustrate the influence played by mobile phones upon this particular group of actors, underlining how arrangements are made:

"R/Q – Let me ask you now, who contacts you normally to transport cattle from one place to another; it is the buyer or the garagaja *that contacts you?*

P/A – it is the buyer.

R/Q – And how does the buyer do that, he goes to your house and knocks on the door, or does he have other ways of contacting you?

P/A –Normally he phones me [using the mobile phone] and we arrange to meet in the market to discuss details.

R/Q – have you used always the mobile phone in your activity?

P/A – yes. […]

R/Q – And how to you think the mobile phone has affected your activity?

P/A – It simplifies it.

R/Q – In which way?

P/A – I can communicate with different people, with my friends to tell them that I need this and that, set contact with the livestock market to ask how things are. You see?"

Interview#38 Sita Gagala – Musuwagaji Senani MKT – Maswa

I collected several similar stories amongst the *wasuwagaji* in different localities, and in all of them, it was emphasized that it is normal for them to spend a substantial amount of time isolated from their families and exposed to different sources of danger. Therefore, the use of mobile phones is crucial to help them maximise their efforts and minimise hazards during the trek, and also to increase the opportunity to conduct more

business, the most important of all being the chance to micro-coordinate some aspects of their household affairs when not physically present:

> *"[…] we can disseminate information to family or to friends or to other places according to the business.*

Interview#37 - Ndebile Ngese - Mswagaji - Senani MKT

Amongst all the challenges that the *wasuwagaji*[92] needs to manage, minimizing the impacts of loss is probably the most important. For instance, if a *musuwagaji*[93] loses one head of cattle, this can represent a minimum cost of 300,000 TZS (£103.03), which is on average what they will have to pay to the cattle owner. If we consider that they received on average between 1,000 TZS (£0.34) and 15,000 TZS (£5.15) per head of cattle transported and delivered, and that on average they do not take more than 10 head of cattle when they trek alone, then the result of the multiplication will suggest months of hard work to pay back for the lost animal, mainly when the explanation for the loss is not satisfactory for the owner. The long quote presented below aims to illustrate one of the strategies used to manage loss during the trek:

> *"P/A – In the past if we lost one animal it would be very difficult to communicate with the owner of the animal, but nowadays, because of the mobile phone, if I lose one animal I can phone the owner to inform him, so he can take action to recover the animal. So, the mobile phone is very useful to us.*
>
> *R/Q – Can you tell me one situation where you had to deal with a similar situation?*
>
> *P/A – One day I lost one out of nine cattle, and after that I decided to phone the owner, and I decided to phone him because I couldn't leave 8 cattle alone to go and search for that one, otherwise I would be losing more cattle. So, I decided to phone the owner and he decided to look for the lost animal himself. He found the animal and he phone informing me.*
>
> *R/Q – Can you tell me if the owner phoned to someone else to look for the animal, or he went just himself and searched?*
>
> *P/A – Initially, he phoned a couple of* wasuwagaji *and asked them if they saw it, and eventually he managed to recover the lost animal and sold it himself to some other person, because I was on my way to the market to deliver the other 8."*

Interview#36 - Mboje Lukumanya, Musuwagaji - Senani MKT

The second most significant use of mobile phones reported by this group is for contacting the family to find out about household affairs. In both situations, it is

[92] This is the plural
[93] This is the singular

possible to find issues of micro-coordination of their activities and of household affairs, and that is the main purpose of the mobile phone usage among a significant number of participants, and the most frequent answer is:

> *"[…] mainly to contact the family and the owner to inform him where I am and how the journey is going. […]*
>
> **Interview#36 - Mboje Lukumanya**

This reinforces the importance of the mobile phone for those actors, who normally use another artefact when trekking the cattle, and this is a sort of symbol of their activity, it is the stick that both the Maasai pastoralists and the *wasuwagaji* use during the trek, it being a sort of extension of the arm:

> *R/Q – ok my last question now, you have the stick that helps you to conduct the cattle and you have the mobile phone, you use the two of them in your work, my question is which of the two is more important?*
>
> *P/A – The mobile phone is very important, if I do not have the stick I can use a stone.*
>
> **Interview#36 - Mboje Lukumanya**

That answer is reinforced by with the following perspective:

> *The phone is more important, because if the cattle get away from the herd you can use many different things to bring it back to the herd, but the phone, no way, no other thing will stand instead of the phone, you will have to use the phone."*
>
> **Interview#37 - Ndebile Ngese**

Those three excerpts aimed to give a sense of how some issues of hazard and security are managed by the trekkers who are more exposed to them, and how some of the mobile phone functions seem to revolutionize their behaviour, management strategies, and options for tackling some of the hazards and risks when trekking cattle. In addition, it enhances the communication possibility, and in a very intangible perspective, it increases the sense of security. This makes the *wasuwagaji* activity to be perceived as better rewarded (they are losing fewer animals and at the same time recovering more animals). But most important of all, they can now contact their families and micro-coordinate their household affairs at a distance. All exposed constitutes important examples of how the integration of mobile phones is helping those actors to develop a more resilient system of production and marketing and at the same time making them more able to self-righting in the face of a massive disruption, i.e. shock.

8.3.3. Mobile phone for negotiation

In the equivalent section presented in section 8.2. I emphasized how the device is perceived as an artefact by the Maasai and as a tool by the Wasukuma. The appropriation of the technology is practiced according to the actor's needs in order to manage the various factors influencing production and marketing, which makes it possible for some of the mobile phone's functions to be revealed and used differently. For instance, in Arusha the device is perceived beyond its materiality, as it is revealed to have a symbolic dimension whereby pastoralists can express their status within the community, and when used for livestock production it allows those actors to have more flexibility and autonomy in resolving key issues from a distance.

In the Lake Zone, and for the Wasukuma, the mobile phone is perceived in a more practical way as an instrument, and ubiquity is the dimension of it that emerges. This allows the producers is this region to streamline some of the livestock activities with more efficiency, one good example being the coordinating of cattle transport to market. Dynamics among the actors also have been influenced by the possibility of being in permanent communication, and here the negotiation can be identified as one of the processes that has been reshaped, which consequently has reinforced the middlemen's role:

> *[…] if I have animals to sell I will contact the middlemen and they will come to my place, check it and determine the price.*
>
> **Interview#26 - Kashinje Tungu**

The above is an illustration of the role of the middlemen and the trust in which they are held, very different to the behaviour of producers in Arusha region who rarely trust the cattle to one that is not known to them already. In Lake Zone the device is reshaping the relations between producer, intermediaries and buyers: trade is now done with more clarity, and this has contributed to the increase in the social capital that flows within the livestock market in the Lake Zone, as the dialogue illustrates:

> *R/Q – How much and how has the mobile phone influenced your business as a trader?*
>
> *P/A – The presence of mobile phones has ensured that around 70% of market information is now clearer.*
>
> *R/Q – and that has allowed you to enhance or activity or not?*

P/A – The level of trade has increased, and the reliability of the market is assured.

Interview#42 – Musa Raphael

This corroborates with my main argument about marketing dynamics in Lake Zone, which is that the region is much more industrialised and the dynamics between different sectors seem more intertwined. It is as if there is a sort of bench marking from one sector to another, allowing for some knowhow and expertise to shift from one arena to another. For example, it was frequently pointed out to me that it is normal for traders and middlemen when visiting a given market in order to trade, to undertake some marketing actions, as illustrated by this trader:

"[…] when I visit the market to sell or to buy, I contact the local sellers or buyers and I ask for the price of the cattle in that market and give them my [mobile phone] number. I do that in different markets.

Interview#26 - Kashinje Tungu

A large number of actors involved in the marketing process said that this is the strategy used by many of the middleman in this region which aim is to strengthen links and reinforce alliances between middlemen, traders and producers, which, supported by the ubiquitous character of the mobile phone, is now easier to implement. This confers the opportunity for each of the actors to play their own role, on their own stage, i.e. they are bound and trust one another, and this is grounded in the fact that the cattle – even though they are still being visually assessed – are objectively valorised in the Lake Zone, and this allows for more trust to flow[94], as pointed out by this interviewee:

"[…] there are times when the middlemen will take all the profit, and there are times when that profit will be split among the parties.

R/Q – and which are those circumstances? When will the middlemen take all the profit for him or when they will share the money with the keeper?

P/A – It is when we arrange the things that way, there are a fix price for the animal and I will receive that money, however we can have arranged ahead that the profit will be divided for the two parties.

R/Q – So, dividing the profit will depend always on the arrangements done before the sell?

[94] Please see my Trust Matrix at end of section 7.3.2.

P/A – Yes, and this will depend on the relationship between you and the garagaja*; if you have a good relation and if we get profit in the trade, then he can come and split with you, but if you don't have a good relationship he is the one getting all the profit.*

Interview#27 - Nhuba Njile

Another particular aspect of the negotiation is that there is a tacit guarantee that the middlemen will never sell below the price, even if there is a need to cover expenses with the relocation or transportation of the cattle from one market to another, as pointed out here:

R/Q – but there are moments where you arrange with the producers that there is not profit, what the keeper wants for that 10 heads of cattle is what you will sell […], so there is no profit. My question is, how do you pay the people trekking animals to the market?

P/A – If a situation like that occurs, I will arrange with the producer to pay part for the transport of the cattle.

R/Q – So, in this case you are not having any profit from this deal, the only one having some profit is the keeper, so why are you paying part of the money to the people in charge of transferring the cattle if you are not having profit?

P/A – I will have to increase always something upon the fixed price for the producers.

R/Q – So you never sell below the price that is arranged.

P/A – Yes, we never sell below the arranged price!

Interview#28 - Juma Mwando

The mobile phone emerges as key, mainly when generating conditions for previous arrangements to be reviewed. We would say that the device is favouring conditions for existing bonds to be strengthened and trust to be reinforced, as suggested:

R/Q – and which one is the mobile phone role in building this trust?

P/A – For instance, it is useful in circumstances when I came to the market and the price is not good; I can use it to phone to the keeper and inform him that the price is not good and ask him to allow me to sell for a certain price.

Interview#28 - Juma Mwando

From the infrastructural point of view, it seems self-evident that the network coverage is making communication more effective is this region, and consequently allowing for more information to flow. For instance:

R/Q – […] it is normal for friends to contact you asking for the price of cattle in a specific market where you are present at a given moment?

P/A – Yes, it is normal. If they are planning to purchase a lot of cattle it is normal for them to search for information.

R/Q – There are any other sources of information, regarding price of cattle, that they use to search for, or it is just the network of friends?

P/A – no, just friends network and using the mobile phone […].

Interview#37 - Ndebile Ngese

Notwithstanding the above, I observed a surprising aspect of this dynamic. In Lake Zone, the power of *dalalis* was not challenged with the appropriation of the device, as the power of the buyer was in Arusha. In the Lake Zone, the *dalalis* are the ones holding the power to negotiate, and that is a consequence of the trust that is implicit in the relationship. For example, in Tinde market the *garagaja* is the only one allowed to stay inside the auction arena. There, they normally hold the stick, which represents the status and the inherent authority[95] they have to negotiate the cattle on behalf of the producers. Despite the increased use of mobile phones to adjust previous arrangements, this has always been the practice and the appropriation process did not manage to disrupt it, which is dictating that predominantly:

[…] the middlemen [are] the ones holding the information. That (LINKS) is more for the businessman, and even if we use it [the information released by LINKS] we don't have ways of transporting the animal. For instance, if I have animals to sell I will contact the middlemen and they will come to my place, check it and determine the price, [which is] always a secret between the middlemen and the businessman. The middlemen don't give me that information, because what determines the final price is how they transport the animals. So, even if I have access to that information I still have to deal with the transport issue. […]. I cannot just organize transportation for the cows, that way we let the middlemen organize things. We do not have much option.

Interview#26 - Kashinje Tungu

This is inducing producers to delegate more frequently to the middlemen the authority to negotiate on their behalf, which gives grounds to conclude that both the producers and the middlemen have different awareness regarding the importance of LINKS, as emphasized by this middleman:

R/ Q - How would you prefer to obtain information, through LINKS or through your network of friends?

P/A - I would prefer LINKS.

[95] In similitude with the Maasai pastoralist and the Wasuwagaji

R/Q - and why you would go through LINKS and not friends.

P/A - because I will have access to the truth of the market.

Interview#26 - Kashinje Tungu

The above statement helps to identify an important issue: in general, producers learned very little from LINKS, and this is due to the initial strategy, which has favoured training to use LINKS just for traders, and not for the trading community at large as the Livestock Marketing Officer and LINKS monitor in Maswa pointed out in the short dialogue that follows:

R/Q – You as a LINKS monitor you have the responsibility and the task to disseminate information, mainly livestock prices, and for this you have received training and instructions to disseminate first among the traders, they were the first targets when implementing LINKS. Did you ever try to do the same with producers?

P/A – Some of them.

R/Q – And how did they react in comparison with the traders, which of the two reacted better to the system?

P/A – Traders reacted best, they were the first being trained. They have recognized the importance of LINKS and the price [for the negotiation].

Interview#44 - Simon Nyagawa

8.3.3.1. Mobile phones as an enabler

The mobile phone has enhanced some of the market's underlying forces, mainly when enabling the negotiation to be done with more flexibility and efficacy, and that is changing the dynamics of the livestock sector in the two regions, although more predominantly in the Lake Zone. Information about markets and prices emerges as crucial in the negotiation process, and it is in this particular aspect that some of the actors (producers and middlemen) suggest that by making use of the mobile phone they will enlarge their network of contacts and increase their chances of obtaining better information and deciding whether it is good to approach the market. This amount of information circulating amongst different networks[96] is claimed to prevent the market from being flooded with animals and therefore the price from being deregulated. Those are some of the important elements of change brought about by the

[96] The network of friends and familiars is the favoured one to search for cattle price or any other market information

mobile phone, which emerges as a key component of the sociotechnical arena, mainly when enabling the search:

"for cattle marketing. Sometimes when we are in the market place, we call the livestock keepers and ask them about the dates when they will be bringing the cattle to this market or to another, and the keeper can answer "yes, I am going to it" or "no, I am not going to it." So, I use the phone for that kind of situation."

Interview#20 - Charles kasuka

The mobile phone has enhanced not only the possibility of gaining knowledge about the volume of cattle that will be brought to market but also the frequency. In parallel, the number of contacts between those actors has increased, and this is giving them the chance to act in anticipation of any sort of issues emerging before or during the trade. For instance, it makes it possible for some traders to adjust the purchase power of the agents acting in the primary markets, as this trader pointed out:

"[…] and which are the issues that you try to solve over the phone with your agent?

P2/A – I can ask how the business is going and if he has money to conduct business there, amongst other issues."

Interview#22Mwando Makenze (group interview)

Furthermore, the mobile phone is increasing both producers' and middlemen's capacity to intervene and contribute to regulating the livestock market; for instance, the opportunity to determine the number of animals that should be sent to a given market and how often it enables them to indirectly act on the system and adjust the price. The mobile phone's ubiquitousness seems critical to help those actors to react for instance to a need for more animals in Pugu market:

R/Q – Ok you received them yesterday (45 cattle) early in the morning and you have already sold all the cattle! Are you expecting more cattle to arrive or just waiting for a business opportunity?

P3/A – Yes, I am waiting for some more cattle to arrive.

R/Q – So, you have already requested for someone in the region to send you more cattle.

P3/A – Yes, and the cattle are already on the way, they have sent them from Tabora.

R/Q – And how did you contact with this agent in Tabora to send you more cattle?

P3/A – I used the mobile phone.

Interview#22Majaliwa Said (group interview)

The flexibility to better, and more quickly, react to market fluctuations is enabling a new mechanism of price regulation between local markets in Pugu. In the above example, it should be no surprise that the prices in the local market will also increase, favouring local producers. Mobile phones, enabling the possibility to make more contacts more quickly and more often. It makes possible for local agents to know with more accuracy what is the maximum price to be paid at the local level for a specific animal. This is possible because they have accessed the price reference in Pugu:

R/Q – and how will your agent know which the price that he should be paying there is?

P3/A – depends on the physical conditions of the animal and the local market price, those will determine how much it will be paid.

R/Q - but how will the agent there know how much he should pay for the cattle […]?

P3/A – Depends on the market and on the value of the cattle. So, I inform them that these cattle should not be purchased above a given price because it will be sold here (Pugu) for a given amount.

Interview#22Majaliwa Said (group interview)

This is a key strand of mobile phone use in this region, which emerges as directly associated with the possibility of coordinating the transportation and trade, because it is now enabling more contacts aiming to strengthen particular strategies. This procedure is allowing for a substantial number of actors to improve their market performance and increase profit as suggested below:

"P/2A – mobile phone makes it easy within the region, I can contact all the agents around, it facilitates all, and without a phone it would be hard to conduct my business.

R/Q – do you think that the mobile phone is directly involved in any increase of profit in this business?

P2 /A – Yes, it is."

Interview#22 - Mwando Makenze (group interview)

8.3.4. Mobile phone appropriation in everyday life

The day to day activities of all the actors were positively reshaped by this device, and not only for livestock production and marketing, as I will describe in this section. As analysed in chapter 7, there are significant differences between the two regions in

respect of the prevailing production systems, pastoralism in Arusha and agro-pastoralism in the Lake Zone. As previously described, crop production is the main sub-sector of activity in Lake Zone, in contrast to Arusha, and the livestock trade emerges as an alternative or complementary activity. In Lake Zone, often profits are used for leisure and knowledge of trade is often hidden from the rest of the household. This concealment is made possible by the mobile phone's ubiquity, with the profit of this secret activity being used:

> *P/A – for leisure, because my wife and my family don't know how I am conducting the business here, but the money that is resulting from farming I use it for family purposes, because the family knows how much it was generated.*
>
> *R/Q – but your family knows that you are also a* dalali, *and somehow, they are waiting for some income, or not?*
>
> *P/A – they do not know …*
>
> *R/Q – but they know you are here in the livestock market?*
>
> *P/A – they do not.*

Interview#28 - Juma Mwando

The mobile phone plays a relevant role because it not only reveals critical information (livestock prices) but also conceals parallel activities, because it is the device that enables arrangements to be made in a very subtle and efficient way. However, when focusing on the *appropriation* process in other areas of everyday life the device is being appropriated in similar ways when compared with Arusha, although there are some nuances of innovative behaviour, such as for example when accessing new mobile services such as *e*-banking to improve activity:

> *"I use it mainly to communicate with relatives, and I use it for banking, to find credit.*

Interview#26 - Kashinje Tungu

However, in general, the device is being largely used for similar purposes to those described in section 8.2. that is, it is being used mainly to improve the micro-coordination of household affairs, especially when having to contact the family during a trekking journey and to send, or receive, remittances using mobile money option (M-Pesa):

R/Q – during your journeys do you use the mobile phone for something else that is not to resolve problems of the livestock?

P/A – besides that, I use it for communication, and I use it for M-Pesa, so I can take or send money.

Interview#37 - Ndebile Ngese

Easing some hardship and allowing for the coordination of more than one dimension of everyday life are two significant changes introduced by the mobile phone into the social lives of those actors. Making contact with their families emerged as the most frequent type of use and this is helping to strengthen family ties. For instance, it enables the *wasuwagaji* during long periods of trekking to more often report the course of the journey as stated by this *musuwagaji*:

"[…] when I am trekking, I can keep in contact with my friends and family and say where I am […].

Interview#37 - Ndebile Ngese

The device seems to open opportunities for new agencies, for instance it seems to be empowering women. The device is giving women the chance to take the lead in some process that in the past they were not allowed to do, for instance when having to sell cattle and send the husband money, using M-Pesa, to solve issues emerging during a trek. But, it is also true that in some circumstances it promotes disruptions that can end up in family breakdown; for instance, wives/partners are now keener to conduct a sort of surveillance of the husbands' activities outside the family environment, as pointed out below:

R/Q – do you think that there is any situation where the mobile phones can play a negative role?

P1/A – in the business I cannot see negative impacts, but in the family life yes, especially in the marriage.

R/Q – Which kind of negative impact it could have in the marriage; can you tell me?

P1/A – … sometimes someone can use the phone to promote some contradictions [conflicts] between you and your wife; and there are the messages (wives are now searching for messages in the partner/husband´s mobile phones). That is negative.

Interview#22 – Said Hamis (Group Interview)

Overall the device is pointed out as critical to help build new forms of livelihood; for instance, there are now two very common activities that can be found within the

livestock market: the mobile phone charger and the mobile phone repairer. Those two activities are giving some people the opportunity to generate a complementary source of income and add to their household income. For instance, arriving at the livestock market also means the opportunity to recharge/repair the mobile phone and set up communications for business or to report to family having arrived safely at the destination. The *simofundi* ('mobilesmith') is a growing phenomenon all over the country, and the communication within the *market* and all inherent dynamics are sustained in one way or another by the *simofundi* operating in the *market*. I observed and spoke with some of these mobile phones chargers/repairers and found out that the business can be very profitable, depending on the investment and the free time to visit different markets. On average, they can recharge:

P/A – around 50 mobile phones [per day].

R/Q –Which time you start working

P/A – around 7am

R/Q – and which time do you finish?

P/A – around 12.00

R/Q – so you told me that this is your only work, it is where you earn money, and this is what (300 TZS) you charge per phone. So, 50 phones should be something like 15 000(TZS), and this money helps you to manage your life for one week, doing your daily expenses. Can you survive one week with this money?

P/A – I still live with my parents; I do not have many expenses. This is my contribution to the household.

Interview#35-Salin

Those are some examples of the variety of everyday life aspects where the mobile is present and changing family and household dynamics through the opportunities made available. Some of these have been embraced in a conservative way, but in some circumstances, they are disrupting old institutions. Those are the reasons why all actors point to the device as being their ally. The device, directly or indirectly, has changed the livelihoods of those depending on the livestock trade, and in this particular case, there were more or less unanimous answers to the question regarding what changes the mobile phone had introduced into the daily life of those people:

P/A – it is simplifying [our] life. **Interview#28 - Juma Mwando**

8.4. Reflection

Considering that, this study involves an interregional comparative analysis, as stated earlier (section 2.3.2.3.) I chose to follow Van de Vijver & Leung (1997, p. 1) methodology for comparative analyses of "different ethnic groups from a single country" and to promote equivalence, i.e. given proportional height to the phenomenon being investigate across cultural context. I interpreted this as a warning, suggesting that we should bear in mind that it is almost impossible to promote a sort of symmetrical proportionately across two dimensions. If we add that the two regions under analysis are diametrically opposite, and the sociotechnical context where they are immersed are different and in permanent change, it makes it even more complex to achieve this symmetrical proportionality. This was the reality where I was immersed whilst conducting my research. Consequently, I held on to the fact that "without a [permanent] check on bias, it [would be] difficult to maintain "full score equivalence" and to interpret the significant cross-cultural differences unambiguously" (Van de Vijver & Leung, 1997, p. 144). For that reason, I attempted as much as I could to eliminate bias where it was identifiable, placing mechanisms to prevent it during all critical stages of this research., The result, as demonstrated in the last three chapters, gives me reasons to have confidence of having achieved something similar to what is suggested to be "scalar equivalence".

8.5. Concluding Remarks

The aim of this chapter was to shed light on how the mobile phone is being appropriated by those producers, helping them to handle some practices related to livestock production and marketing, those action illustrating what I have presented in a more conceptual and abstract way when introducing the analytical framework. Throughout the chapter, I presented evidence that the mobile phone is interpreted as an enabler and constituting and artefact with symbolic value for one group (Maasai) and a tool/instrument for the other (Wasukuma), but in both cases helping them to tackle production and marketing constraints. For instance, in the case of the Maasai producers in Arusha, the evidence supports the perspective that the device has given them the chance to embrace the changing world, because this is now a more fluid

context. For instance, in what concerns production, the search for places to graze the cattle is no longer such an uncertain process. The possibility to talk frequently to one each other is giving those actors the chance to invert perceptions that the "land is shrinking". The device as giving them a new dimension of time and space, therefore seen the land as expanding in the measure that the affordances disclosed is enabling new options and opportunities for action. This is what I tried to anticipate when pulling together my analytical framework, suggesting that the appropriation process would fluidize the context and generate waves of opportunity to be surfed by users. Another important aspect, and now under the marketing point of view, those new options made available are giving those pastoralists opportunities to handle the binominal distance/price differently, this has been made more flexible with the access to information regarding market prices, which has become the key affordance of the mobile phone for that group of producers. This is empowering both groups in the measure that the power agency is shifting from the middlemen to producers, which now have more arguments to present during the negotiations. This is probably the most significant change enabled by the appropriation of mobile phones, and this is changing the way those producers interact with the livestock market, which constitutes the main research question.

In the other side, I have highlighted the perspective of the Wasukuma, who are more sedentary, and have a different strategy concerning livestock production and accessing markets. Producers in this region use different approaches to move cattle to and from the market. For instance, to send the cattle to a secondary market, which sometimes is a complex process requiring motorised transport, the mobile phones are now claimed by users to be an essential tool in the coordination of that routine, mainly when enabling permanent contact between the *dalali* and other players participating in the action. This can be underlined as an innovative way of acting which was enabled by the mobile phone. Recalling, when I introduce the analytical framework the appropriation process was conceptually described as the innovative way of using the technology, and this constitutes a key strand of the appropriation process. The flexibility and coordination possibility that the device affords one with is helping the Wasukuma to simplify the transportation process, which for them is very important

due the volume of cattle daily shipped from primary to secondary markets, and from there to the final market in DSM.

Returning to the negotiation process, and when contrasting the two region we will note that the presence of *dalalis* in Arusha region is not as prominent as in the Lake Zone, because in this region the producers prefer to sell directly themselves and the most frequent option chosen for moving cattle is by trekking. However, the mobile phone is no less important, especially for obtaining critical information regarding prices. This is helping those to change their possibilities, even if the device is being appropriated in a very conservative way, and only in very few circumstances challenging old institutions. However, when doing so, it is transforming very embedded and important institutions and agencies, namely the rigid social structure of the Maasai, where gender and age can emerge as factors constraining one possibilities of participation and decision within the community. In this case I pointed out cases where the women pastoralists are able to trade in the marker and where young pastoralist are having more changes to ascend in the hierarchy because now they are able to enlarge the herd with less constraints, and number in this case matters.

Another important aspect is flexibility to manage time and distance. This is another important affordance disclosed during the appropriation process. This is critical for both groups at the marketing stage, because a producer cannot miss an opportunity to conduct a good business deal and very quickly. That is why the presence of *dalalis* and middlemen near the end of the production/marketing chain is now more accentuated in order to speed up the process. In this particular, time management also emerge as an affordance enabled by use of mobile phones and it plays a significant role in both production and marketing processes, mainly when intensifying the communication and helping to connect all the actors involved. Evidence shows that there are now more feedback loops between all actors involved in the trade, and this is making the activity more resilient, considering that now they have more mechanism of reaction to any unpredictability occurring, and this, in very generic terms, illustrated the consistency of my analytical framework which has made possible to identify and analysing those important occurrences.

The other aspect emphasized in this chapter was the management of loss. The data from the *wasuwagaji* provided important material about the difficulties to which those actors are exposed and some of the strategies that they use to overcome those problems; and the most significant indicator is that they use their mobile phone to manage three major risks: Loss, Theft & Threats. Those three represent the extreme conditions that a less conscious judgement or misfortune can expose them to. I would describe them as a sort of circumstantial apex, and if we attempt to link each of them, they will necessarily form a triangle. By this, I mean that any journey done without the possibility of being in communication has high possibilities of leading to one of those apexes. All of the herders interviewed had been exposed at least once to one or more of them.

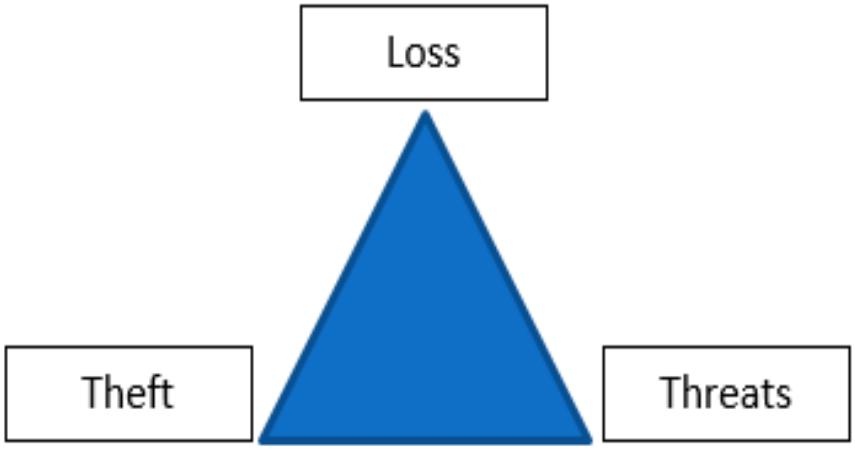

Figure 34 - LTT triangle (created by the author)

Loss represents the apex of the triangle, and it can happen through cattle being killed e.g. by a wild animal and/or misled due to cattle behaviour, and it represent a significant percentage of the abnormal situations occurring during the trek. Theft and threats, such as facing force when trekking and grazing within the corridors for wildlife, are the other two frequent hazards to which the wasuwagaji are exposed, and they are more numerous during night trekking. Those three risks factors can be classified as the major ones in the *wasuwagaji* activity, and the consequences can be classified as direct (affecting the *wasuwagaji*) or indirect (the owner). However, the penalties seem to impinge only on the *wasuwagaji*, because, as pointed out by one of the interviewees, it is they who will have to pay the real and full price of the animal if

they have the misfortune to lose one or more of them. That is the reason why I am placing loss at the apex of the phenomena affecting not only the *herder* or the *wasuwagaji*, but all the actors involved in the network, from producers to buyers, and from intermediaries to transporters. Loss is something that no one can afford: one animal is a significant asset and the event of a loss can affect all the actors in the chain, particularly the *wasuwagaji*, and the mobile phone, as I have illustrated, is enabling different options for tackle it and helping them to bouncing-back as advocate in the resilience literature.

In conclusion, the chapter has illustrated the dichotomies between the two regions, which is very relevant to support the comparative analysis, and has underlined how the *appropriation* of mobile phones is being done in those two regions. In some circumstances, the *appropriation* is very similar in both regions (such as mobile phone use in everyday life), but in others (production and marketing) chapter 8 has shown significant differences. Nevertheless, the appropriation of the device is, one way or another, helping those actors to cope with different constraints and making the all sub-sector more resilient.

In the next chapter, the focus will be more particularly on the market and will illustrate how the mobile phone is reshaping some of the market operations. This will correspond to a more institutional vision which aims to illustrate how the mobile phone is challenging or complementing LINKS.

Chapter 9 - How mobile phones are reshaping some market operations: challenges and opportunities for LINKS

9.1. Introduction

This chapter will examine how the state experts view the orderly reform, envisaging the full transformation of the livestock sector. I will underline how pastoralism and agro-pastoralism were overtaken by the arrival of what I call the new sociotechnical arena, i.e. LINKS, whose objective is to give those actors the opportunity to access price information regarding the livestock market and therefore create conditions for better management of their herds, primarily in formal trade.

This chapter comprises four sections, with 9.1 and 9.4 as introduction and conclusion respectively. In the main body of the chapter, I shall introduce the perspective of the mobile phones as an enabler within the sociotechnical arena (9.2.), discuss how mobile communication are supplementing LINKS and then (9.3.) how the mobile phones are being used to leverage the future of pastoralism. In 9.3.1. I shall introduce some services and products emerging from both the public and private arenas aiming to complement LINKS and (9.3.2.) illustrate how the use of mobile phones is helping to decrease the competition for land and natural resources.

The strategy is to point out some market operations and behaviours that have been changed by recourse to mobile phone use, and some situations where LINKS is being challenged or complemented. This is expected to help conclude the debate opened in chapter 5 where a brief history of LINKS was outlined.

9.2. Mobile phones as an enabler within the sociotechnical arena (LINKS)

Recourse to technology seems to be alleviating some of the constraints affecting livestock production and generating some new avenues for exploring the relationship of technology with society. For instance, access to new markets has been improved by the availability of mobile phones, and this has enabled some key changes in market relations, for instance some entrenched agencies have been challenged, the power agency (mostly the power to bargain) being an important example. This agency seems

to shift from one set of players (intermediaries) to another (producers), and this has unexpectedly changed the market dynamics.

In this section, the discourse will focus more specifically on changes promoted by the continued growth of mobile phone usage among producers, traders and buyers. Also, I shall describe how the mobile phone is reshaping some fundamental market relations and generating results that were expected as outcomes of the dynamics to be generated by LINKS, which was implemented in order to improve the livestock trade. In this particular, evidence show that those changes are not the direct result of the transformation envisioned by the policy makers. In contrast, they are emerging as the result of a second order of effect of the mobile phone appropriation by livestock producers. This is upsetting the politicians' vision of a more industrialized strategy, and this seems to be distancing LINKS from the core of the change.

9.2.1. Mobile phones: opening up new possibilities for livestock market players

My evidence suggests that the mobile phone opens up new possibilities for autonomy and flexibility and that they are generating new dynamics in livestock activity in both of the regions under analysis. This provides reasons to suggest that the device is an enabler, not only enabling the user to build autonomy and flexibility but also opening up possibilities for policy-makers to promote change. As analysed earlier, this allows some agencies to shift from one practice to another, promoting some interesting production variations and new trade relations amongst players in both Arusha and the Lake Zone.

Supported by my observations and the data collected, it is possible to suggest that those realities where not anticipated nor included in the sociotechnical arena as possibilities, and therefore their practical usefulness was not merged into the envisioned policy which had aimed to promote changes and to push some market activities towards the strategy intended by governments when implementing LINKS.

Rather, data collected in both regions has reinforced my perception that the mobile phone is opening up a parallel line of action within the livestock market, which better

serves the producers. The evidence corroborates my arguments and supports the ideas that **i) t**he use of the mobile phone in livestock trading is increasing**, ii)** that it is rarely used to check the formal price through LINKS, and **iii)** that the informal side, or the network of friends and relatives, is the privileged channel for marketing cattle. The possibility to act fast and choose which channel (as per the Decision-Making Model – figure 35 in the next page) to explore to find the information needed, is a new option enabled by the mobile phone, and it is giving the producers the opportunity to make an impact on the system.

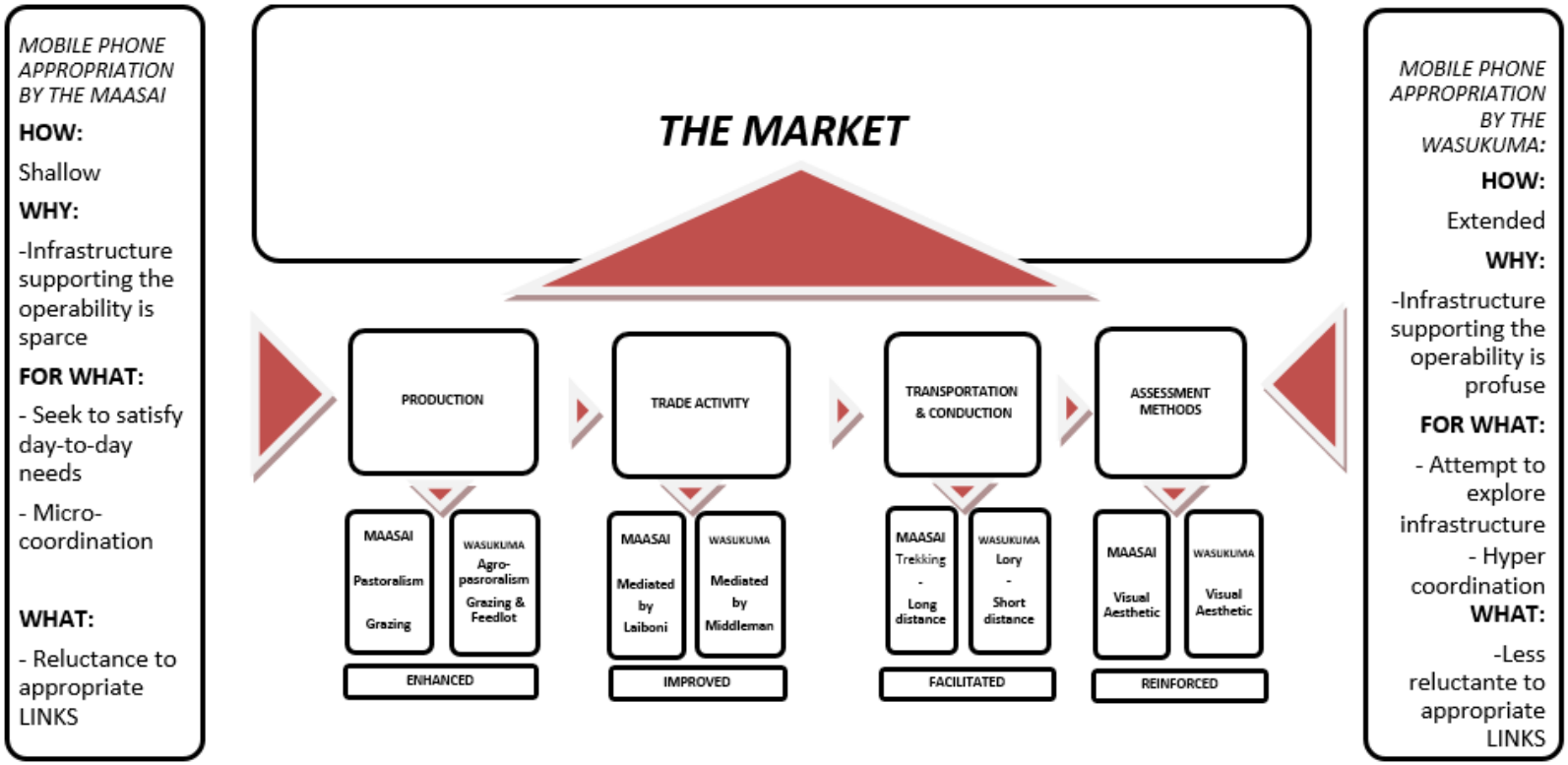

Figure 35: Decision-Making Diagram (created by the author)

The above aims to illustrate the ongoing sociotechnical transformation of the livestock market. I had the opportunity to verify in all of the markets that I visited an increased use of the mobile phone to trade, a relevant detail being that it is rarely used to check LINKS. When those producers need information regarding price they search for that information using the network of friends and relatives, a privileged channel for marketing cattle, making the absence of LINKS from the day to day activities even more obvious, mainly with regard to price consultation. There are grounds to restate that the process of implementing of LINKS is still deferred. Underlining causes relate to the mismatch of interpretations regarding the usefulness of the sociotechnical arena, i.e. the information that it is not providing (such as the cattle price) and its inaccessibility (slow access and relevant time response from the server), which demonstrate its inoperability. This is determining that the channels used by producers (pastoralists and agro-pastoralists), intermediaries and traders, are frequently parallel to the formal ones. In this context, the mobile phone emerges with a double façade, as it can give access to official information (LINKS), yet at the same time it opens doors to the parallel networks of information which exist on the informal side. Nevertheless, one way or another, the mobile phone is giving those producers more flexibility and autonomy to respond to market demands, as pointed out by this relevant actor:

> *"[Through mobile phones] they are being informed of market conditions, number of animals and the prevailing prices per specific grade of animal, animal of grade 1 today is being sold let's say 800,000 TZS, and if they hold the animals there (in the regions) the price may drop by 50,000 TZS. So, to maintain the price they control the number of animals that can come to the ground (Pugu). First, knowing the marketing conditions, prevailing prices, time demanding for stock. Let say this is Ramadan [we were in the middle of Ramadan when this interview was done], the fasting month for Muslims, probably the number of animals or demand for meat should be reduced, because lots of restaurants and people prefer not to eat meat, so the number of animals should be less. So, they inform that this time they should not bring lots of animals to the Pugu livestock market.*
>
> **Interview19 - Mr Shasha, Zoo Sanitarian Inspector at Pugu**

The quotation above illustrates one strategies used by traders to try and control the flow of animals arriving at the main market in DSM (Pugu) and consequently to shape the daily price, which naturally will influence the cattle price countrywide. This dynamic and fluid way of operationalising the flow of cattle arriving at Pugu is something that was not written into the design of the sociotechnical arena. The

architecture of the infrastructure, and the way in which it is managed, does not allow it to respond quickly and with the flexibility that those dynamics demand. In contrast, traders and producers when using the mobile phone to permanently adjust particular strategies and needs, are the ones influencing and regulating the price reference, which later will be used by LINKS as a reference, a dynamic which I have previously flagged up as the users acting on the system. This is one relevant possibility enabled by mobile phones during the *appropriation* process, and it is giving the producers the malleability to adjust particular strategies:

> *"… the mobile is used to improve the livestock marketing information system. Once when there are lots of animals in the ground these farmers or traders use it to contact their counterparts based in the regions and inform that Pugu is overloaded with animals, that they should reduce the shipment of cars to this market, so they can balance the number of animals according to their constant purchase power in the grounding. This means that if there are lots of animals they are fetched at a low price, if there is a bit of scarcity they can improve their incomes."*

Interview19 - Mr Shasha, Zoo Sanitarian Inspector at Pugu

Therefore, the activity emerges as regulated by a sort of individual and private mechanism and supported by the use of mobile phones, as underlined again by Mr Shasha:

> *"[…] it is an individual mechanism, and it goes this way; there are a number of registered livestock merchants and they have their agents here in Dar es Salaam, and they tell them 'we need this number of animals' and the quality or quantity of animals the market is demanding […]. So, the information is passed to the agents there in the [far] off country so they know what type of animal is being demanded in the market for the time being."*

Interview#19 - Mr Shasha

The mobile phone has brought more dynamics to market actors and upgraded the trade community with more flexibility to permanently adjust their particular strategies.

> *Sometimes when we are in the market place we call the livestock keepers and ask them about the dates when they will bring the cattle to this market.*"

Interview#20 – Charles Kasuka

Nevertheless, trade is not confined only to the internal market; there are alternatives where producers can take more profit than usual, mainly when selling specific animals, such as Tanzania special or grade 1 animals, for different market contexts. This was something that I observed during a visit to Waso market in Arusha region. Here the

trade with Kenyan buyers is intense; possibly as many as 60% of the animals sold in this market are shipped to this neighbouring country. Reinforcing this observation Mr Manumbu emphasized that the above phenomenon is known as informal cross border trading, which in my view corresponds to what I have identified as another of the new possibilities made available by the mobile phone: i.e. ***the flexibility to search for new markets***. This makes it possible for producers to search for and reroute their destination. For instance, in the case of the Maasai producers from Waso the search and rerouting are frequently taking them to Nairobi, both as a source of information for daily prices and as a destination of the cattle to be traded, and not to DSM as planned in the LINKS architecture, which has not contemplated border markets as a source of information for reference, notwithstanding being known by the government:

> *"Then you have the trade with Kenya, there is this zone market and the livestock border market, where the animals are taken and sold there. So, the Kenyans are going there searching for the Maasai, and you cannot distinguish them, which ones are Maasai from Tanzania and which are from Kenya […]. That is, boundaries issues are very difficult to manage, especially in the border from Lake Victoria up to Mombasa and Tanga, and animals are crossing there. I did a study in Crossing Border Trading, it is very interesting to note the prevalence of informal cross border trading […] and I […] found out that there is a lot of resources wasted."*
>
> **Interview#2 - Mr. Manumbu**

The idea of resources being wasted, introduced by Mr Manumbu, points to the consequences of the best Tanzanian animals being sold to (or in) Kenya. My interpretation of Mr Manumbu thinking is that if the system (LINKS) is not taking the advantage from the best that producers can offer then this will represent a waste of resources and lessen efforts to create a structure to support the trade in a more formal and market orientated way, which is the role stipulated for LINKS. This helps to underline a key idea; mobile phones are changing some traditional market relations. The above is made possible by the opportunity of setting set up communication more frequently with different sources of information regarding markets and buyers. Stakeholders from different locations, and countries, can now communicate with more frequency and share information, which is extending the market to neighbouring countries, which is a good example of the flexibility and autonomy brought about by the mobile phone.

However, that in itself does not represent the most relevant phenomena concerning market dynamics. There is one key aspect that I suggest as very relevant. Data collected supports the idea that there are some key agencies shifting from one side to the other of the trade relation, and that shift is favouring producers, as now they have more flexibility to gain access to price information, more often and fast (frequency & speed). This is a significant change and it is empowering producers to bargain, something that until very recent was almost impossible, because producers would have to sell for the price offered without any opportunity to say, "*I want this much*". This is what I refer to as one of the most important changes enabled by the mobile phone, *i.e*. helping to set up fairer deals, as suggested by this trader in Pugu:

"P/A – I used the mobile phone to bargain a price today.

R/Q – With who?

P/A – With one customer.

R/Q – And how many heads of cattle have you transacted with this customer?

P/A – About 50 cattle.

R/Q – And how did the negotiation end up?

P/A – We agreed over the price, we agreed that the price was reasonable for the cattle.

R/Q – So you did the negotiation and the trade over the phone.

P/A – Yes, I did."

Interview#21. Final - Ramadam Athuman – Trader

The mobile phone is determining that time and space are shrinking into one dimension, which I shall call the *technospace*, because now it is possible for producers to quickly (the time dimension) trade at a long distance (the space dimension), and to accomplish transactions without needing to have the tangibility of the coin[97]. All of these features should constitute the attractiveness of LINKS, but for different reasons they are not working: there are claims that the reliability of the data is questionable (Mr Aron Luziga's evidence), the infrastructure supporting the operability is not strong (quality

[97] M-Pesa service give the opportunity to make payment over the phone, (Morawczynski, 2009)

of the signal) and not sufficiently stretched (the dimension of the network)[98] over the country to make the service efficient.

Those producers with recourse to mobile phones have the opportunity to intensify communication (in frequency and amplitude), and that increases the likelihood of almost all the activities of the livestock market to be (re)dimensioned. This was another relevant aspect changed with the *appropriation* of mobile phones in the two regions. For instance, traders from Pugu can now give agents in the regions more instructions and with more frequency and therefore can make sure that they adjust strategies to respond to demands in accordance to market fluctuations:

> *R/Q – How many times did you speak to your agent today regarding issues of cattle trade? […]*
>
> *P2/A – Around ten times, but it could go until twenty times.*
>
> **Interview#22 – Collective, participant 2**

The possibility explored above – new ways to coordinate business – is giving producers the chance to quickly react (time dimension) to any *impromptu* demand for stock, and this is probably one of the factors that was changed in respect of market dynamics. By having the option to coordinate the flow of cattle arriving at the market, it makes it possible for actors to maximise their efforts and reduce their general costs, mainly of transport (space dimension). Cattle are now taken to Pugu according to market demand, giving those actors opportunities to include more flexibility in their daily operations, as argued by this participant:

> *"P3/A – yesterday I sold 45 cattle.*
>
> *R/Q – and those 45 cattle they came in one day and from one region, or in different days and from different regions?*
>
> *P3/A – They came once and all from Tabora.*
>
> *R/Q – and when did they arrive?*
>
> *P3/A – yesterday early in the morning.*
>
> **Interview#22 – Collective, participant 3**

[98] The national grid of mobile communication still imbalanced, with a massive concentration of communication towers in the main urban centres and scarce infrastructure in rural areas.

I suggest that the new opportunities made available by the mobile phone makes it possible to replace, or enhance, some classic competitive factors such as the **physical resource, knowledge resource, capital resource, and infrastructure resource.** The mobile phone is now emerging as a key competitive factor in itself given that all those classical and basic competitive factors seem to be incorporated in the technical affordances of the mobile phone. The evidence gives reasons for arguing that the use of mobile phones is facilitating the management of important resources.

At present, information regarding livestock (knowledge resource) can to be easily accessed, independently of the chosen channel[99]. This is decisive in making business more profitable (capital resource), and therefore in making producers less dependent on an institutional infrastructure (LINKS) to run their business (infrastructure resource), since all these are now more manoeuvrable through new possibilities that have emerged with the *appropriation* of the mobile phone. This is a significant change for both pastoralists and agro-pastoralists, because:

> *"[…]it facilitates the communication in my business. Instead of going and find someone manually [i.e. physically] mobile phone can make it easy to find them.*
>
> *R/Q – And do you think that you would be able to run your business without the mobile phone?*
>
> *P/2A – Mobile phone makes it easy within and out of the region, I can contact all the agents around, it facilitates all, and without a phone it would be hard to conduct my business.*
>
> **Interview#22 – Collective, participant 3 - Pugu market**

To conclude this section, as I have illustrated, it can be argued that the use of the mobile phone:

> *"[…] makes the communication process easier, it facilitates. Because for the first time, after being introduced, and if I want to do some marketing, I will contact the farmer, and the* dalali *to connect me with someone to make the transportation easier. Before the arrival of mobiles phones the situation was very harsh, but after the establishment of the network coverage it becomes easier to contact with* dalalis *and others. Also, it facilitates the network marketing. After the introduction of mobile phones, it becomes possible to use the full packing capacity of the lorry. If you are alone your couriers can take more, we can go with 10 cattle from Dodoma to another place and there take another 10 and until the final destination the courier will be full, which means that the cost of transportation will be reduced."*
>
> **Interview20 - Charles Kasuka\\Interview#20**

[99] This can be done through the formal or informal channel as per my decision-making model (9.2.1.)

This has brought significant impacts amongst key players in the livestock market and has changed some of the dynamics and relationships amongst those actors, but all this is taking place at the informal side of the livestock market, thus keeping LINKS at the fringes of the real livestock market dynamic.

9.3. Using mobile communications services to leverage the future of the livestock sector

One key factor shaping attempts to promote change in the livestock sector is uncertainty about natural resources, and this underline production trends in both Arusha and Lake Zone. For instance, when the production process is surrounded by uncertainty (Arusha), the evidence shows that producers will depend more on the high-density stock approach, which is a key argument of the resilience approach (which claims that one should have more assets in order to decrease vulnerability to risk). In production processes shielded by certainty (Lake Zone), producers normally have a low stock density as strategy, because they do not need so many animals in order to cope with any unpredictability brought about environmental or socioeconomic changes.

It is in this context that mobile communication, and inherent services, emerge as a new reality helping those producers to manage production, and to reduce risk. This is not only because that technology makes it possible to find or to gain access to natural resources or critical information with fewer difficulties, but because it is also giving them an opportunity to access new options for enhancing production. Services such as *e*-veterinary, or products such as *e*-financial services, are now present in the day to day lives of producers. Thus, the use of ICTs to gain access to mobile services can be perceived as one of the levers used to pull the livestock sector from the subsistence level and push it towards the idea of a market-oriented positioning, as argued by Mr Aron Luziga. This consequently increases expectations about the possibility of pursuing some of the goals set out in the National Strategy for Growth and Reduction of Poverty (NSGRP), popularly known as MKUKUTA, which is the basis of the Agricultural Sector Development Strategy (ASDS).

9.3.1. How new mobile communication services can reinforce LINKS

Strategic alterations at communication and financial sector levels are enabling livestock producers to have more access to mobile communication and financial products in rural areas and therefore helping them to cope with the pressing need to change production strategies. For instance, one major mobile communication operator brought to the market in 2014 a service that was planned to work as an extension (or complement) to *M-Pesa*, making the access to small credit more flexible, as pointed out by the head of Revenues and Marketing Planning of Vodafone Tanzania when describing that the:

> *"MPawa (Mobile Power), launched in June 2014, is a system of credit that will allow registered customers in the electronic bank (M-Pesa) to have in a short time access to loans up TZS500.000.00 (£156.25). This is a product aiming to support people with low income to generate business and to improve their livelihood standards.*
>
> **Interview#52Albert Maneno**

The service referred to above is just one example of the investment being made by the public and private sectors to create better conditions for the less well-off, which will favour sociotechnical transformation, and make it more likely to happen. Those changes represent significant efforts to promote new services, such as the *e*-financial products, which are expected to embrace more livestock producers and facilitate the implementation of LINKS. Regarding the public sector, and at the level of the regulators, there is an ongoing process of adjustment of strategies between the telecommunications operators and the financial sector over trying to consolidate one sound strategy to increase real possibilities for the less fortunate fringe of the Tanzanian population, as advanced by the Head of Planning, Research & Risk Management Unit of the Tanzania Communication Regulatory Authority (TCRA) when stating:

> *"[…] that strategy is there. In fact, we have the communication strategy, led by the Universal Communication Service Access Fund (UCSAF), whose main role is to ensure that communication and services are sent to those places where these operators think it is not profitable, that it is not communicable. So, that fund is used to finance investments in those rural areas, where services are supposed to be [present]. The UCSAF it is a separate organization like TCRA, with a Director General [DG] a body and management […] under the Minister of Communication Science and Technology, but it is an independent organization; they make their own decisions and other things. However, funding is coming from this sector. We TCRA we are contributing with a*

percentage of the resources, and all operators are contributing with 1% of their gross revenue to that fund, but they are the beneficiaries of that fund as well, because what the fund does is to help go to rural areas where there are no communication services. They have identified those areas and then they prepare a bid, because they know exactly how much it costs to go and to put the network; so, they prepare bids; the bids are advertised, the operators bid and whoever wins is given the chance to go and to implement the project there. So, they are contributing to that fund and they are using the fund to build services in the rural areas [the project is called Go Rural]."

Interview#51- Lucas Mwalongo

Certain actors, such as Lucas Mwalongo, argue that there is a pressing need to set up a macro strategy to take ICTs to rural areas and therefore promote conditions for services such as LINKS to become a reality and to help regenerate the agricultural sector, mainly because it is argued that the:

"… combination of growing demand in the developing world and stagnant demand in industrialized countries represents a major opportunity for livestock keepers in developing countries, where most demand is met by local production, and this is likely to continue well into the foreseeable future." (Thornton, 2010)

This has also changed how pastoralist and agro-pastoralist communities interpret and embrace change, inducing them to look at new activities and new techniques of husbandry, such as to search or ask for advice regarding vaccination campaigns or new techniques to improve production such as artificial insemination and crossbreeding. Surprisingly this is taking place amongst the Maasai pastoralists, as pointed out by the District Veterinary Officer of Ngorongoro, Dr Choby Clement Chuba:

"You know, the Maasai are very aware of the contributions that is coming from science and technology. Very much aware, even more than you can expect. They are the people who, I would say, more frequently search for advises about the diseases, and what they are supposed to do. They are aware and keen to receive any scientific advises about diseases, and how they should act. You know, when I was employed[100] in 2010 as the district veterinary officer, just by knowing that there was a district veterinary officer […] all people used to come now and again to ask about different issues. I think that they are ready, this is positive and very important, and actually I can say that they are receptive, which is very important, more than anything."

Interview#56 - Choby Clemente Chuba

There are some critical areas within the livestock sector where mobile communications are playing an important role, not exclusively to help to manage tensions regarding access to land and natural resources management, but also to change production

[100] What the DVO intends to say is "when I started", because at the time of the interview he was still the DVO for Ngorongoro district

strategy and push them towards new techniques to enhance the herd health. Evidence suggests that the use of mobile phones is helping them to better coordinate efforts with experts and local authorities to prevent or control livestock disease outbreaks. This was pointed out to me by the District Veterinary Officer of Ngorongoro:

> *"… in 2012, or 2013 I think, we had a big programme which was founded under the Wellcome Trust, it was about the use of android phones, imported systems. So, the phones, which were normally imported under the normal system of the government, were distributed to livestock officers and to some people on the field, who we called the Community Animal Health Workers. So, what they were doing was just to open the IP collect, you know an open form to answer questions, about what they know regarding animal diseases or outbreaks, and then report. That system was done in a simple way, it was a very [effective] system, because it involved producers, veterinary people, and medical people. Myself, as the district veterinary officer, I could access data through mobile phone, or information that were sent by the veterinary people, or distributed in the office; or just access to system to send data at the same time (synchronisation) to the personnel from the investigation centre. I had the server password, and the guy from the ministry could see (monitoring/coordination) all the people informing what was going on, […] and the Community Animal Health Workers were the Maasai, from the community. Of course, we had some difficulties, some people arriving were illiterate, or sometimes they were coming from the village or from a very remote area, and we had to give them an android phone, with a touch screen, you know is quite a new technology, but they were beyond that technology, and they use it."*
>
> **Interview#56 - Choby Clemente Chuba**

This example not only illustrates a specific action where it is possible to emphasize the willingness of those producers to participate in the sociotechnical transformation of the livestock sector, and again in this particular case using a smart mobile phone, to report diseases outbreak. These sorts of initiatives are also helping those producers to move forward and try to solve some chronic issues regarding cattle health, and, most importantly, they illustrate the appetite to embrace modern technology and to tame it when trying to bounce back to cope with struggles, as advocated by the resilience approach.

9.3.2. How mobile phones are helping to decrease competition for land and natural resources

As shown previously, the mobile phone is helping actors find important alternatives to cope with their struggles, and one of them is to diversify production activities, investment and assets, and thus reduce their vulnerability to risk and simultaneously

decreasing tension and conflicts over access to land and natural resources. For instance, those semi-nomadic communities, when having access to mobile communication services, tend not to relocate so often and not too far, and this can be described as a new coping strategy. The mobile phone is the technology responsible for this new strategy, not only when disclosing new opportunities but also when intensifying some tacit and local knowledge, which is often within the region that they inhabit, and therefore makes some cohabitations conceivable. For instance, alternatives to grazing cattle within the wildlife corridors emerge associated with the flexibility to permanently reroute the trekking trajectory. This was a possibility intensified by the mobile phone, which is helping to moderate competition, and promote conditions for demystifying some incorrect perceptions about the relationship between pastoralists, the environment and wildlife as pointed out by Butt & Turner (2012, p. 2) when arguing that:

> *"… the inconsistency associated with characterizing the relationships between wildlife and livestock arises from confusion over the definitions and interpretations associated with the term competition [suggesting that there is a need] to increase rigor in thinking about the competition among wildlife and livestock."*

The same point was underlined by Mr Choby Clemente Chuba, Veterinary District Officer in Ngorongoro region, as a relevant aspect of the livestock herds' management, when he suggested that the needs of those producers should be embraced in what concerns land management policy at large, because:

> *"… this people existed there for a long time ago. We just come to discover that they are there today, but they have been there for so long, and with their livestock."*
>
> **Interview#56 - Choby Clemente Chuba**

In this aspect, I agree with Butt & Turner because my perception regarding the future of livestock production in both regions also emerges as connected with the need to better understand the relationship between livestock production and the use (and sharing) of key natural resources. With regards to this Mr Aron Luziga suggests that wildlife corridors and land demarcation are fundamental. However, there have been some issues:

> *"At the beginning, we started to demarcate land within the villages, but we came to realize than when you do the demarcation in a single village, this people don't graze the cattle in a single village, they move the cattle according to the season. For example, in the rainy season they go on the highlands in different villages, and during the dry*

season they go to the low lands, which were flooded up to the border. During the rainy season, they keep moving from one district to another and one region to another. So, now we are going to protect those big bits of land according to their movements and try even to open a livestock corridor, which will be demarcated for them."

Interview10 - Mr. Aron Luziga

Therefore, it is important to underline that land resource, and how competition for that resource can be managed, can impact on cattle quality and this will positively influence the sociotechnical transformation. This is because the pastoralist and agro-pastoralist communities are now not only in dispute over natural resources with natural and traditional competitors for pastures, such as the wildebeest and zebras, as they are now in dispute with government authorities and private investors who are seeking to expand other sectors of activity, such as the gaming-controlled areas, into crucial grazing areas, as pointed out again by Mr Aron Luziga:

"… you know now we are having this new registration, which now entails the measure and the length of the livestock needs, so they can be given a lease, and this is a very big challenge now, we as technicians we want to settle them, and them themselves, and the NGOs that says that are helping them, they don't want us to settle them, they want them to continue to move from one area to another. But, if we accept that thing for sure the pastoralist will lose all the land, because poverty is increasing and the project for land use is very big due to mining, tourism, wildlife and so on. If we don't do this type of things the need for graze land automatically will be taken by some people […]. So, the big thing now is land demarcation, for example this year we have allocate a lot of money which will go for demarcation of land."

Interview10 - Mr. Aron Luziga

Mobile communication is proving to be important in addressing key requirements of pastoralism, such as the need to be mobile, and this can also help to solve issues of competition for land. The degree of autonomy and flexibility that it offers allow producers to readjust their strategies, as emphasized by Kashinje Tungu, an agro-pastoralist from Tinde, Shinyanga region, who stated that:

"… if the weather is not good and there are short pastures, I will go anywhere, mainly in the dry season."

Interview#26 - Kashinje Tungu

In a similar line of reasoning Timothy Oleyaile, who is the Pastoral Women's Council (PWC) programme coordinator in Longido, and a livestock keeper, emphasized that pastoralists' movements are part of the culture of communities traditionally inhabiting

the Arusha region, such as the Maasai:

> *"… it is something that we have always done; presently is critical because the land is shrinking, forcing us to move permanently in order to find good pastures and water to feed the herd. With the mobile phone, we can communicate with one another and inform where the good grass is and where not to go because of the thieves or the military forces, and therefore increase our action."*
>
> **Timothy Oleyaile, Programme coordinator for Longido**

However, pastoralists (Arusha region) and agro-pastoralists (Lake Zone) interpret mobility differently. It emerges as almost compulsory for the former and as an option for the latter. Some of the multiple factors that producers have to deal with on a daily basis when managing herds, or when undertaking common tasks of husbandry, are a determinant factor in both regions. Intrinsically, land management emerges as a key driver of the future of livestock production. As Homewood et al. (2001) have argued "pastoralism as a way of life is increasingly threatened by these land use changes", [and as] "competition for land intensifies [...] resilience of mobile forms of livestock production diminishes" (Waithaka, 2009), and the future of the sector will become even more uncertain. Therefore:

> *"… addressing the nutritional constraints faced by pastoralists in extensive rangeland systems in the developing world is extremely difficult. While there is potential to improve livestock productivity in semiarid and arid areas, probably the most feasible solutions require integrated application of what is already known, rather than new technology. This could involve dissemination of information from early warning systems and drought prediction, for example, so that herders can better manage the complex interactions between herd size, feed availability and rainfall". (Thornton, 2010, p. 2859).*

It is in this context that the mobile phone emerges as a key component of one possible strategy to be used when trying to develop a new strategy for the livestock sector, mainly because it can supplement LINKS with more reliability. From a more technical point of view, it is useful to reconsider the role of the early warning system (LEWS), the predecessor of LINKS, since meteorological information is a fundamental component of livestock production, and concerning the interactions between herd size, feed availability and rainfall, the dichotomy between the two regions is obvious. For instance, Arusha, mainly the Ngorongoro district, is much drier than the Lake Zone, and this significantly determines production outcomes, and has other implications; for instance, the quantity and quality of animals that one producer can maintain per herd in both regions may vary. It is normal to find in Arusha region herds with large

numbers of animals of category 4 and 3, and in the Lake Zone to find small herds with animals of category 2 and 1. This reinforces the idea that the Lake Zone has moved towards a semi-intensive regime, and producers there are more market orientated than in Arusha region. The reason for this is due to the fact that the former need more quantity of land, time and assets (typical in extensive regimes) to produce the same volume or value of the latter, which with less basic resources and key input (feedlot) can produce better results (typical in intensive regimes). Here I use the perspective presented by Thornton (2010, p. 2859) to support the argument regarding the future of livestock, mainly when suggesting that:

> *"In developing countries, if livestock are to continue to contribute to improving livelihoods and meeting market demands, the [introduction of] farm animal genetic resources will be critical in helping livestock adapt to climate change and the changes that may occur in these systems, such as shifts in disease prevalence and severity."*

However, it seems to me that the above is not the only, or most fundamental requirement. There are other steps to be taken if the transformation is to be fully achieved. For instance, my field observation suggested that some of the basic structures supporting the livestock chain needed to be improved and upgraded urgently. A call for this was made about twenty years ago. In 1997, an important document was issued regarding the opening of the Dodoma abattoir. The document summarises the construction of the infrastructure from early stages to the opening of the abattoir. A set of critical points was emphasized as fundamental to help promote changes in the livestock sector, in particular in Dodoma region, but in my understanding also applicable to Tanzania at large, mainly in some of the chief production regions. Yet, almost 20 years after what was prescribed in that report, the reconstruction of some key infrastructures is still far from being a reality and similar problems are now extensive in all of the regions that I visited. The report summarises the need to:

> *"… rehabilitate existent, but dilapidated structures, and replace them with functional and purpose-built infrastructures which would [eventually] be privatised. [The markets are needing to] be equipped with basic auction ring, pens and holding grounds with improved pastures and watering facilities. Holding grounds [need] to be enclosed in order to prevent market-adjacent rangelands from over-trampling. Simple quarters [need] to be constructed for drovers and livestock field assistants. To ensure stock movement in an environmentally sound manner, with less disease, social and predatory risks, the [market structure need to [be] rehabilitate/construct [with] stock routes […], holding grounds, [and] night camps, and [the] veterinary check points [need to be*

completed] with dip tanks, vaccination and watering facilities at strategic points along the main stock routes. The [restructuration also need] to revive essential veterinary back-up and extension services by providing a revolving fund to ensure the supply of essential drugs and appropriate veterinary equipment. [Finalising, there is the urgent need to] to improve the marketing information system […].” [101]

The above quote would represent with a reasonable degree of accuracy my fieldwork observations. It appears that there is a need to include all those factors – land management policy, reassessment of key instruments (LEWS & LINKS) and the basics infrastructure (markets) – in a large context of action in order to bring to reality the intended transformation. It seems a complex process, but it is already taking place, and the Lake Zone can be a good example to bench mark at a national level. In recalling the reasons for implementing LINKS to support the change, it is important to point out that the system was advised[102] as the solution to solve the lack of information and communication between key structures of the livestock network. However, due to its architecture, design, and model of implementation, the solution is not working, as suggested by Mr Manumbu:

“… you know, these livestock keepers frequently, because of the limitation which makes information not being available, use [friends’ network] to have access to information. You know information is power, and if you have no information, you have no right to speak. So, if you give them outdated information, because information is needed daily or hourly, those guys will have it [by other means], because they need to move the cattle to the terminal market. So, if you are not giving them the cattle price probably they will make their own decision, and sometimes they bring the cattle to Pugu while there is a lot of animals there. If they could have been told [informed] earlier, that there is a flood [of animals] and the price is going down, they wouldn’t have to ask the price between them [and take the animals directly to DSM].”

Interview#2 - Mr. Manumbu, Assistant Director

Consequently, the future of pastoralism in Tanzania emerges as entangled in a set of required transformations that must be coordinated through one sound strategy in order to profit from the investment applied and resources used to change the state-of-art of the industry. My results bring understanding that this is not an exclusive matter of land demarcation, or just rethinking LINKS. They are both important, but the strategy needs to be more inclusive and encompass the full livestock chain from production to transformation industry, as suggested by Mr Aron Luziga:

[101] http://www.afdb.org/en/documents/document/tanzania-livestock-marketing-project-completion-report-12703/, accessed on 20/03/16.
[102] in a process, similar to a top down model of reform

"For example, now we are having some investors from China that are putting an abattoir in Shinyanga. This abattoir is expected to slaughter almost one thousand cattle per day. We are having some investors from India that are going to put out 4 abattoirs, one in Shinyanga, one in Dodoma, another one in Mbeya and another one in Ruv, which is another region of Dar es Salaam [80 km from DES] and some Chinese that are putting 2 abattoirs in Dodoma. A part of that, the government itself is putting a big abattoir in Rufu, which could be slaughtering 800 cattle in a day, and also an abattoir in the southern part of Tanzania, in Sumbawanga, known as SAAFI [Sumbawanga Agricultural & Animal Feeds Industries], and another one in Morogoro known as Tendaji Foods Ltd. So, all these abattoirs are going to create a link with the livestock producers and so they can define the market and therefore producers will know what to produce [quantity and quality]."

Interview10 - Mr. Aron Luziga

In addition, there is also a pressing lack of experts, training, and trained personnel in respect of the livestock sector which is preventing the sector from shifting the production paradigm. These are the reasons why the Ministry of Livestock is seeking to enlarge the network of Livestock Training Agencies (LITA). For instance, the agency (Tenguru – Arusha) which I visited during the pilot study, is the biggest in the country; the structure has capacity for 400 students and offers five training programmes: Diploma in Animal Health (DAH), Diploma in Animal Production (DAP), Diploma in General Agriculture (DGA), Certificate in Animal Health & Production (AHPC) and Farmer Training (FT), aiming to improve human resource capacities and efficiency and to deliver livestock services to all districts.

The above is expected to allow the knowledge transfer of skills from experts to livestock farmers and the sharing of information and experiences amongst stakeholders. This is planned to converge practical/tacit with the scientific knowledge in this particular field, and to build capacity and awareness based on traditional knowledge, therefore increasing livestock production and productivity. Those livestock agencies are structures operating under the responsibility Ministry of Livestock and Fisheries Development, being part of the institutional framework to try and change productions strands. According to Mr. Balija Luyombya[103] the:

[103] Director of the Livestock Training Agency in Tengeru, Arusha. This structure is a part of the Directorate of the Research, Training & Extension Services at the Ministry of Agriculture, Livestock and Fisheries. Information collected from the interview done in the first phase of my fieldwork (Arusha, November/December of 2013)

"Livestock Training programmes are coordinated by the Directorate of Research, Training & Extension and implemented by six LITAs namely: LITA Buhuri, LITA Madaba, LITA Morogoro, LITA Mpwapwa, LITA Temeke and LITA Tengeru. The role is to build technical capacity to respond to government demands with regards to livestock extension human resources that could link the public with the private sector by doing extension, i.e. shifting knowledge and policies from the public to the private arena."

Mr. Balija Luyombya, Director

In addition, there are plans to promote the use of techniques emerging from the field of livestock genetic engineering (crossbreeding), which is expected to help enhance particular characteristics of the local breed of cattle, the Zebu. This should generate animals with the capability to gain weight quickly and the capacity to resist the challenge of particular regions. Dr Choby (DVO of Ngorongoro) suggested that:

"… you will have the animals that have the characteristics to endure the challenges of Ngorongoro, and at the same time increasing the performance. So, increasing productivity performance without affecting its ability to tolerate the challenges of Ngorongoro, like diseases, or other challenges is key, and at the end of the day you will have an animal that can weight 500 kg and produce maybe 5 litres of milk. Do you think that a Maasai would have 1000 animals, maybe not, and maybe there will be no conflicts between the wildlife and producers?"

Interview#56 - Choby Clemente Chuba

In conclusion, there are a set of strands to be taken into account when projecting the future of livestock in Tanzania. The modernisation of the sector encompasses the need for some key institutions in Tanzania to speak with one voice, and in that sense some relevant steps have already been taken. As pointed out earlier in this chapter, since 2001 the Tanzanian government has put in place a macro strategy, the Agricultural Sector Development Strategy (I & II) and the Agricultural Sector Lead Ministries (ASLMs) are trying to draw up an institutional framework aiming to settle the foundation for the industrialisation and commercialisation of Tanzanian agricultural outputs.

The above seems like a realistic stepping-stone for transformation to take place, however evidence suggests that the immense efforts and resources required will slow the pace of change. For example, the reconstruction of basic infrastructures, which is a fundamental and basic component of the change, is still not achieved. The marketing

and information system (LINKS), as pointed out, has significant fragilities preventing it from being a real option for the producers. Therefore, it appears that to try and shift the paradigm from a subsistence model of production to a market orientated paradigm, without having accomplished those two basic stages and components of a major structure, will be a hard task, not to say almost impossible.

However, this is not to suggest that the future of pastoralism is compromised, rather, as I have demonstrated, the livestock sector has potential, and LINKS can be the trigger. However, for that to happen, the convergence of the top-down with the bottom-up needs to be explicitly addressed, reassessed, and (re)implemented, taking into consideration the perspective of the users because they are the ones leading the sociotechnical transformation of the livestock market.

9.4. Concluding remarks

This chapter aimed to look at the role of mobile phones within the market and show how the appropriation of the device is challenging or opening up avenues for the ambitious sociotechnical transformation. In this particular, evidence shows that changes are taking place, however they are not the direct result of the top-down transformation envisioned and attempted by the policy makers; rather, they are emerging as the result of the bottom-up mobile phone appropriation by livestock producers. This is bringing some variations across the two regions in respect of production and marketing stages which disrupts the policy makers' vision of a more industrialized strategy.

Amongst factors contributing to this state of affairs there are the potential of the mobile phone to generate more autonomy and flexibility, which is making those variations possible. The data presented also suggest that there is a dynamic and fluid way of operationalising the interregional flux of cattle, led by key stakeholders especially middlemen, and this was something not written into the design of the sociotechnical arena. For instance, traders using mobile phones to permanently adjust particular strategies and needs, are the ones influencing and regulating the price that will be later used by LINKS as a reference. As such, the process of implementation of LINKS is still deferred. Underlining causes point to the lack of an adequate social learning

process because it is clear that there is a deficit of knowledge of LINKS, i.e. its purpose and how it works. In parallel, the infrastructure supporting its normal functionality (a national grid of telecommunication towers) is deficient, which makes the signal weak within production areas. Also, when the system is known by the users, and when they attempt to use it, it does not provide responses to producers' requests in a timely manner. So, the need to have more and adequate information in order to set the bargaining process has to be found in alternative channels, such as the network of friends and relatives, which is much more reliable. In these circumstances, the costly national LINKS is not needed and has no place.

The above constitutes another opportunity to illustrate how my analytical framework can capture relevant frames of the ontological world, which can help to identify patterns of action. In some cases (Lake Zone) is suggesting innovative activity or by opposition (Arusha) pointing to a certain degree of inertia. The attempt to implement LINKS is a good example to backup this claim. The case shows how the suppression from of one important component of the social learning component can affect the appropriation mechanism, e.g. it can generate negative input to and generate inertia. Clarifying, and taking the Maasai group as example, the lack of adequate social learning process has indirectly produced reluctance on the main group in what concerns the use of LINKS to check livestock prices. In a more mechanical perspective, I would say that the lack of social learning has induced a negative input and locked any possible affordance of the service to be disclosed, therefore preventing the occurrence of feedback loops. This, consequently, has blocked the retro-activeness between the two main components (appropriation-affordance) of the framework, consequently disabling opportunities for users to unlock further affordances enclosed in LINKS. This not only illustrates some design gaps, which causes can be pointed to a lack of sound judgement with regards to the perspective (top-down or bottom-up) to be used to make the implementation of that service effective. My argument is that the top-down approach used, when not including a stage of social learning process has contributed for low levels of adoption. In this case this is express in the low percentage of users which are aware of the system, and in the expressive number of producers that were never able to identify any relevant affordance and therefore rejected LINKS. This will now be discussed in depth in my concluding chapter, which follows.

Chapter 10 Conclusion

10.1. Introduction

This study set out to understand the implications of mobile phone appropriation by the Maasai and the Wasukuma. The main research question was: *To what extent is the appropriation of mobile phones changing pastoral lives, and how is the mobile phone changing the way pastoralists interact in the livestock market.* Grappling with this question suggested to me that I develop an analytical framework to build understanding of *how the livestock market is structured and maintained* and *what is the role of the mobile phone when supporting market interactions. Creating this framework, I find* brings improved understanding of sub-research questions, i.e.: *who are the key actors involved around pastoral production and the roles they play; market structures; how the technology supports producers, and with what consequences*. I will now revisit the main conclusions and answers to these questions, shedding light upon mobile phone uptake by those two groups of livestock keepers. The study shows that the mobile device has been highly relevant in helping these livestock producers tackle some of their challenges and change their livelihoods. In this context, the strategy to approach the *market* emerged reshaped due to the increase in mobile communication and some of the affordances disclosed (e.g. flexibility and mobility) by the mobile phone, mainly in the context where sociotechnical infrastructure favours different level of appropriation. The study also has highlighted important aspects of the mobile phone adoption by those actors, whose appropriation has given them the opportunity to reshape some important aspects of livestock production and marketing, providing me with an opportunity to address something that had not been much discussed. Those findings are the result of my analysis which were supported by the analytical framework developed to conduct this research. The outcome of this process argues in favour of a new perspective, allowing me to suggest the extension of the concept of "*appropriation*" (Williams et al., 2005) by adding a possibility of a *spectrum* from *shallow* to *extended* according to the context of use. This will provide a better understanding of the adoption and impact of ICTs in developing countries, which constitutes the main contribution of this research.

10.2. Changing the pattern of livelihoods

10.2.1. New forms of livelihood in Arusha

Pastoralism is the dominant system of agrarian production amongst the Maasai, a semi-nomadic people, where access to common land is a critical production factor. This pose increasing difficulties for pastoralists in their daily lives. For instance, restrictions upon seasonal movement, which consists in taking herds to the north and from the north to the south according to the dry and wet season, is a problem which has been increasing for many decades. It dictates new directions and forces the pastoralists in some circumstances to embrace new or alternative livelihoods.

The constraint on movement, one of the most visible factors affecting those pastoralists' lifestyle, has increased the competition for land and inherent resources and has aggravated tensions and disputes, and intensified old and unresolved rivalries. This suggests the need for new life choices. In the case of the Maasai the pressure is pushing them to embrace new forms of livelihood such as artisanal mining, working as security guards in DSM, or becoming tourist guides. Concerning the Wasukuma, one of the more common options is to become intermediaries, or to take up agro-pastoralism and small-scale crop production either for self-subsistence or for exchange in local markets for other goods.

Against this background, the mobile phone has opened new perspectives and possibilities of action. As I have been arguing the appropriation has enabling changes that disclose new affordances and this has contributed positively to changing livelihoods. The mobile phone's main affordance (making one available to another at anytime and anywhere) has brought new possibilities, namely when helping to obtain more information for production and marketing. Also, it has given access to new options to purchase, send or receive money using e-services such as the M-Pesa. My findings here help to answer the question: *what are these changes, and how they are affecting the way of life*?

10.2.2. New forms of livelihood in the Lake Zone

The dominant system of agrarian production in this region is agro-pastoralism, and the Wasukuma are traditionally more sedentary than the Maasai and depend mostly on cotton, rice and maize crops. The region has more natural resources, such as better soils and more sources of irrigation, than Arusha. The need to be mobile, in order to gain competitive access to pastures and water resources, is not as pressing as it is in Arusha. Nevertheless, the perceived decrease in rainfall, coupled with other socio-economic factors, is contributing to the decrease in crop surplus, and this is not only shaping their particular strategy (Ngitili) to manage land as it is obliging the Wasukuma to shift resources which normally were channelled to their main activity (growing cotton, rice and maize crops), investing in small-scale farming of tobacco, tea, coffee, sugarcane, bananas and sunflower. Surprisingly, this has increased the need for stronger animals to be used as draught power when undertaking those new agricultural activities.

Therefore, I can claim that those changes have contributed positively to the dynamic of the region, not only regarding crop activity but also livestock production and trade and the appropriation of mobile phone has significantly contributed for this state of affairs, namely when enabling those actors to interpret the context as more fluid, where each affordance disclosed induce a different level of appropriation and that opportunity to disclose further affordances. For instance, in chapter 7 I analysed the substantial differences in production methods between the two regions. Data analysis suggested sharp differences between the Wasukuma and the Maasai. In the manner that, the latter, who need to move their herds from one place to another for different and strategic reasons – those movements can be short[104] or long[105] in distance and in time, has perceived the lengthy, in time and space, process as easier to handle when adopting the mobile phone. This is giving those pastoralists more chances to find solutions for the lack of pastures but also to undertake the traditional movement season[106], and most importantly it has given both groups of producers the chance to reshape their

[104] Supported in the *Ngitili*, which is the strategy used by the Wasukuma people in the Lake Zone
[105] This is a drought coping strategy used by the Maasai from Arusha region
[106] (Spear & Waller, 1993), p. 77

perception in what regards the ontological world, making possible to decide in an autonomous way where to go and graze and quickly reach better markets.

My research scrutinised the strategies used in production and marketing in those two regions and the findings suggested that the inclusion of mobile phone in their day to day activities is very important supporting key decisions. For instance, locating good grazing areas and sources of water has always been a major constraint for the Maasai. In the past they used to trek their cattle for days with the uncertainty about gaining access to those two sources of nutrients. Presently, there are more options to quickly access different sources of information about them which are swiftly disseminated amongst members of the clan. This has changed their perception regarding the context, which is now perceived as more fluid, e.g. it has made both time and space to become more flexible, allowing for tasks and some processes to be accomplished more rapidly (time dimension), and therefore reshaping the notion of distance (space dimension). This makes possible to argue, as I said earlier, that there a new perception of those two dimensions, which is the outcome of the appropriation mechanism interacting with the affordance mechanism, resulting in multiple options for action. One good example emerging from this research is that trade is now frequently done at a distance and without the tangibility of the coin. All this has brought more efficiency and a new sense of security. The appropriation of mobile phone, which implies making use of key affordances, is assisting producers to manage critical moments of uncertainty with more flexibility and autonomy, mainly when facilitating the process of searching for information, which has opened up more opportunities to operate in the livestock market. The research findings also suggested that the mobile phone is not only helping those producers to reduce the impact of those negative factors but also to generating new patterns of interaction amongst key actors within the *market*. This inference is supported by material explored in chapters 7 and 8 and makes it possible to argue that the mobile phone is assisting pastoral communities to: **i)** search and find better pastures and water and; **ii)** obtain more information to assist production and trading activities; **iii)** enhance the livestock producers' bargaining power and reshaped the negotiation process; **iv)** to manage constraints with more certainty. Additionally, **v)** it is opening up more opportunities to trade in the market, and in parallel to micro-coordinate household affairs; **vi)** in the case of the Wasukuma, is increasing their capacity to

coordinate operations (transportation and conduction) because it has brought more flexibility to communicate, and last but not least, **vii)** the mobile phone is promoting the convergence of the user's needs with the policy maker's vision, and most importantly it is making the activity in all its cycles more resilient.

Table 12 (next page) seeks to compare the two regions. It shows that they differ in almost all factors influencing production, so the search for alternative forms of livelihood also differs between Arusha and Lake. For instance, the fact that the sources of nutrients are more concentrated in the Lake and dispersed in Arusha makes those producers invest more or less time in reaching similar results. As an illustration, the substantial difference in distances travelled by both groups to gain access to those resources makes the quality of the cattle differ between the two regions. Better animals are found in the Lake Zone than in Arusha and this has implications, mainly when trading cattle.

As such, I can underline that those factors are crucial, and, in some circumstances, they contribute to some producers changing activity and abandoning livestock production as their main source of livelihood. This is more common in Arusha where the constraints keep on pushing the Maasai producers to activities very different from cattle keeping. In the Lake Zone, changes are subtler, and they occur within the agro-pastoral activity. When the producers there are forced to change activity, they focus on specific crops. Therefore, specificity and objectiveness emerge as key characteristics of the Lake Zone. Wasukuma pastoralists normally will sell and buy for very specific reasons, for instance it is frequent for them to sell two cows and buy one bull for use as a draught animal just after the rainy season so as to enhance possibilities of a good harvest in the seasonal small crop activity.

In Lake Zone, frequent recourse to middlemen is justified in that the availability of information is increased, supported by the existence of more technical telecommunications infrastructure to communicate.

The above explains why the mobile phone is ubiquitous in the Lake Zone in comparison to Arusha. This has increased the level of social capital, making trust to be more accountable. When comparing Arusha and the Lake Zone one major similarity between the two regions is in the cattle quality assessment method. To pull the cattle's

tail (see section 6.1.) is a custom throughout the country, which is justified on the grounds of being more practical, and this pushes those producers to conserve traditional methods as the main form of quality assessment. All those aspects determine the choices they make regarding production strategies.

The table 14 in the next page summarises key differences between the two regions, which were presented mainly in chapters 7 and 8. It helps to illustrate the dichotomy between the two regions and demonstrate in a more systematic way the factors that influence the appropriation of mobiles phones for livestock production and marketing. This will help support the argument in the next section, where these observations highlight the value of a comparative study in understanding differences and similarities between two contrasting regions.

FACTORS INFLUENCING PRODUCTION AND TECHNOLOGY APPROPRIATION		
MAASAI - ARUSHA		**WASUKUMA - LAKE**
Pastoralism	Production method	Agropastoralism
Extensive	Production regime	Semi-intensive
Grazing	Fattening regime	Grazing & feedlot
Dispersed	Source of nutrients	Concentrated
Pressing/long distances	Mobility/Distance	Moderate/short distance
Less rain, arid	Rain pattern / Land typology	More rain, semi-arid
Pushed by constraints	Reasons for trade	Driven and strategic
Specific occasions	Trade frequency	Frequent
Direct, instructed by the Laiboni	Trade activity	Mediated by intermediaries
Rare	Use of transport	Frequent
Symbolic/Subjective	Cattle value	Material/Objective
Visual/aesthetic	Assessment methods	Visual/aesthetic
Sparse	Infrastructure	Profuse
Shallow	Appropriation	Extended

Table 14: Contrasting the regions (created by the author)

10.3. Appropriating the mobile phone to cope with production and marketing constraints

Here I will contribute to further the discussion on *appropriation* (Sørensen, 1996, p. 10; Williams, Stewart, & Slack, 2005). Throughout the thesis I have explored that concept, vis-à-vis the concept of *affordance*, being both key elements of the analytical framework. The concepts emerge as two sides of a coin, each one is the catalyser of the other. To appropriate implies disclosing any given affordance of a technical artefact or system; that is a *sine qua non* condition. Consequently, when talking about appropriation we should always hold implicit that there are affordances being disclosed and used, which makes the device meaningful for those two tribes, both instrumentally and symbolic.

In using those two concepts to set up my analytical framework I generate better chances to understanding mobile phone use amongst those producers, and to some extent to explain the limited appropriation/usage of LINKS. Those two concepts turned out to be important in building my argument and help to explain how the mobile phone is being integrated into the day to day activities of the Maasai and Wasukuma producers. The concepts contributed, mainly in the Maasai pastoralists' case, to explaining how those producers seek to get involved in a modern way of conducting their main activity and how they micro-coordinate household affairs.

The mobile phone has brought more agility and has improved both face-to-face and distant relationships. For instance, those pastoralists now have more facility to micro-coordinate household and family affairs and to communicate and access market prices and trade with more profit. The device also constitutes a mechanism enforcing trust, mainly when they have to convey their cattle to someone that is not part of their network of relationships to trade on their behalf. I will return to this issue later. This gives grounds to state that the *appropriation* of technologies such as the mobile phone can be described as facilitators. Taking this further, if we observe the livestock market as a sector, and we interpret it as a broad network of actors (human and non-human), it is then possible to place the *appropriation/affordance* as the mechanisms enabling the change, namely when enacting *resilience*, as suggested in my analytical framework (see section 4.7.)

In addressing this topic, there is substantial evidence supporting the idea that the mobile phone has increased the possibility to communicate for both groups of producers and to address some of the factors influencing production presented in table 12. Some constraints are now handled with more efficiency (due to greater flexibility and frequency of communication), which has positively affected the production and market dynamics in both regions. I would like to emphasise one important aspect which I mentioned when laying out my analytical framework. There, I suggested that the most important function of the mobile phone was to make us available to one another. Autonomy to press a set of numbers on the keyboard and then pressing a green button to place a call is a significant affordance of this medium and will give any user, in particular the Maasai and Wasukuma producers, the opportunity to handle any constraints with more efficiency. The greater flexibility and frequency of communication generated by this medium has positively affected the production and market dynamics in both regions under analysis.

For instance, constraints such as the lack of pasture and access to water are now easier to handle because the search process alternatives have been made easier by the availability of information brought about by using the mobile phone. In the past the search for pastures and water used to take days or weeks and frequently producers would end up decreasing the density of their herds. Today, the mobile phone has provided the opportunity to better manage that constraint, for instance it is now much simpler to change routes and to find new destinations with more accuracy, and this has increased opportunities to manage time and space and to do so more efficiently. The mobile phone is changing those producers' possibilities, because it is giving them the chance to be more actively involved in the livestock marketing, even though sometimes not making use of the formal channels made available by government structures.

10.3.1. Market dynamics and changes resulting from the mobile phone appropriation amongst the Maasai and Wasukuma producers

I will now reintroduce my analytical framework and illustrate how the two mechanisms influence each other, and as result, they enact the third mechanism (resilience). But before that it is important to recall that the dynamic of appropriation depends on the sociotechnical infrastructure available in a given context. This is what will fuel the technology to work, and therefore allowing the user to identify and disclose different levels of affordances (see table 9 in chapter 4). This will result in determining the different possibilities for action. Nevertheless, I would like to underline independently the socio-material condition of a given context, there will be always a given level of appropriation occurring, which implies a given typology of affordance being disclosed. Looking to this specifically and by region, it is possible

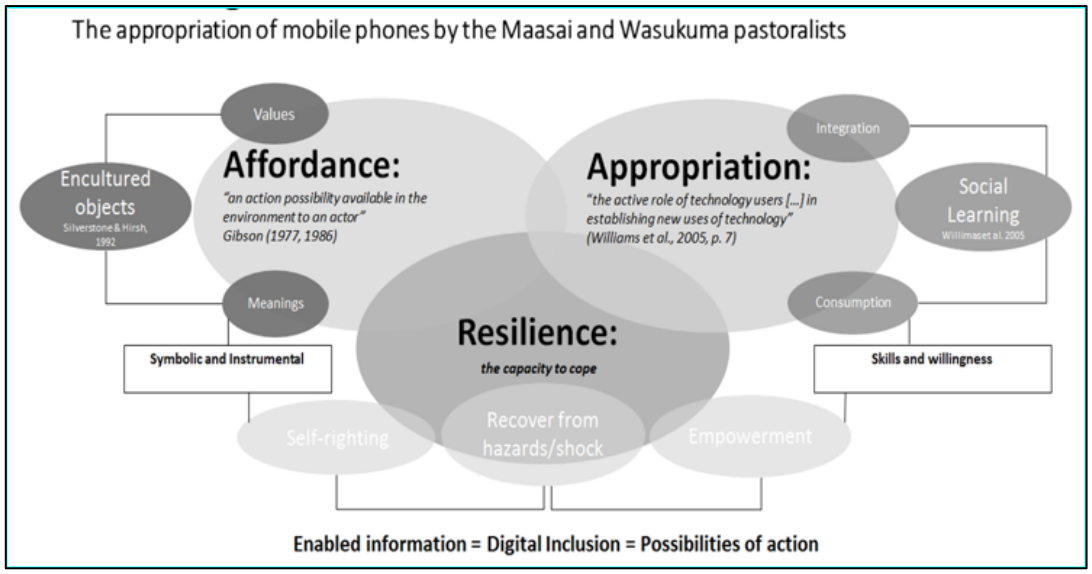

Figure 36 - Appropriation diagram

to point out Lake Zone as a good example of where mobile phone appropriation has increased response capacity to coordinate aspects such as vehicle and pedestrian of herds to the *market*. The mobile phone has given the couriers (lorry men) and *wasuwagaji* (trekker) the autonomy to make contact with the owners and family at any time and place, and this is a significant change. In the past, they did not have resources in hand to quickly communicate situations of hazard and danger, yet they frequently encountered situations of high risk.

Therefore, the device has enhanced their sense of security. The appropriation of mobile phones has provided both groups of producers with new patterns for decision-making which are now more strategic. The appropriation and use of this technology have made the access to information less constrained, consequently made the marketing process to become more profitable. Also, production emerges enhanced, trade improved, transportation facilitated, and the assessment process reinforced by the possibility of one to communicate to another. For instance, by making use of my analytical framework to study those two groups of pastoralists, it was possible to depict one particular pattern of behaviour of the Wasukuma, they are innovative, which helps them to be more prone to embrace, or promote changes. However, it is also important to note that the region offers better conditions to use ICTs, mainly from the infrastructural point of view. The infrastructure has enabled possibilities for different levels of affordances to be explored, and that has opened up new channels for gaining access to information such as agricultural prices[107], which are now less restricted. That information can be accessed via official sources or parallel channels such as networks of friends, which can be contacted using the mobile phone.

Those variations, in practices and performativity, is what my analytical framework seeks to underline. The two mechanisms (affordance and appropriation) feed each other. Once one is activated, the other will be automatically switched on through the feedback loop process, and this will enact positives levels of resilience. The same is to say that, under a perceptual perspective, they will give those actors opportunity to see the context differently, i.e. as having more opportunities to act, and to tackle some important constraints affecting their lives.

Shedding light now on Arusha, it is possible to argue that similarly to the Lake region, the increased use of mobile phones has promoted important changes. It has allowed improved communication processes and consequently has given the Maasai the opportunity to be more judicious with regard to their decisions to move their herds for both marketing and production purposes. Also, alongside the increasing number of factors favouring production, the use of this technology has helped the Maasai to

[107] The region is the major producer of cotton, rice and maize which are supplemented by fishing and mining activities, transforming the region into an industrial cluster where the communication infrastructure is critical and therefore greater.

reduce tensions and conflicts with farmers in disputes over access to water, and also with military forces patrolling the national parks and reserved areas where pastoralists are not allowed to graze or water cattle. This is an important change, mainly because it has changed how those producers interpret the context, which now emerges as more fluid and affordable in what concerns opportunities for action. Besides that, there is a second aspect to be underlined, namely the dynamics generated within the *market* context, which has become an important aspect of this research. Mobile phones are an important component of the ongoing changes in the dynamics and relationships with others market players. Since it is now easier for the pastoralists to find more information regarding livestock prices, this has allowed them to uncover intermediaries' attempts to cheat or to introduce opacity. Those attempting this may undermine their own reputation and end up losing the chance to do business. For that reason, we can point to the mobile phone helping those actors to reinforce their bargaining power and to reshape the negotiation process, mainly due to its ubiquitous character, and making the need to resort to traditional forms of trust less necessary, contributing to the increase of the level of social capital, mainly in the Lake Zone, especially in contexts where the spectrum of appropriation is extended.

Nevertheless, notwithstanding those important changes, it can be said that the mobile phone use did not disrupt some existing conservative practices and trade customs amongst the Maasai, and it has reinforced the innovative behaviour of the Wasukuma. In the first case, it has opened up a space and reinforced one traditional channel of communication amongst the Maasai, namely the contact with the Laiboni, following a traditional pattern of communication. This is now more flexible and frequent. For instance, it ensures that the price to be paid for livestock in a given market is in accordance with the instructions of the Laiboni and with the seasonal expectations. The Laiboni is the one who has the authority and capability to provide that market information because they believe that he can foresee the future.

With respect to the Wasukuma and the Lake Zone, the mobile phone has enhanced the region's potential for livestock production. It has allowed information to be entrenched in the regional context and become infrastructural. This has permitted market players to take for granted some market information and allowed them to delegate to a third

party (middlemen) to trade. This can be contrasted to market dynamics in Arusha, where trade is done mostly without resource to the middlemen's intermediation.

In generic terms, I can point out that the ubiquity of the mobile phone is ensuring that the information required to support negotiation is now more available during trade. However, the existing technical infrastructure is still weak, although better in the Lake Zone due to the presence of other industries, and this emphasizes the dichotomy between the two regions. Nevertheless, the mobile phone has increased the agency of the Maasai and the Wasukuma livestock keepers, which is helping them to reshape the bargaining process.

Consequently, the recurrent use of mobile phones when trading is altering some important social relations amongst producers and buyers, and this can be a plausible answer for the question: *how can we best characterize the role of the technology supporting the interaction within the livestock market, and with which consequences?* This suggests and extends Ensminger's arguments, on the grounds that the mobile phone is helping those producers to "*capture the gains from broader trade and specialization [which is helping them] to develop more complex intuitions. This is making possible that people who have no kin relations, and perhaps no prospect of future dealings will cooperate in good faith*" (Ensminger, 1996, p. 25).

As such, and when looking at the role of the mobile phone in this process, I would say that the device being integrated in a context where there is more infrastructure to support its use can favour the bounding of social and commercial ties and make trust and solidarity to gradually become more organic. It enforces conduct and makes mutual reliance possible and therefore allows the ties to exploit the resources more efficiently (Steven Lukes (1984), in *Intro* to Durkheim, 1893, p. xvii), based on the ubiquitous surveillance that the mobile phone enables. From the production perspective, it can contribute to constraints being accommodated with less impact, and to determining livestock activity to be more dynamic in both regions. One good example is the processes of transportation. The way in which cattle are conducted to market has changed. The integration of mobile phone technology in pastoralist's day to day activities improves the coordination and efficiency of market-related decisions.

10.3.2. Changes in trading activity

Focusing now on trading activity, I will initially examine the Maasai to describe the changes occurring in Arusha. Nevertheless, it important to note that there are some important aspects and practices which have not been disrupted by mobile phone use, like in assessing cattle's vigour and weight by pulling their tails, and in depending on the Laiboni instructions about the base price for negotiation. Trade in Arusha is still heavily grounded in traditional practices, and the Maasai producers continue to base their decisions on tacit and/or practical knowledge. There are claims amongst the Maasai that the verification procedure does not serve their purposes, and they prefer to trade on the basis of their culture and traditional practices and not use weighing scales, even though this would introduce greater accuracy, it would also force them to ignore the symbolic interaction with those with whom they trade.

In this particular my fieldwork observations suggest that some traditional practices (aesthetic assessment + pull tail) do not favour those producers (mainly the Maasai) because they introduce more ambiguity and make the bargaining process more difficult. Furthermore, it is clear that the use of mobile phones is allowing for agency to be transferred from the middleman to the livestock producers who end up with more power to bargain. The device has balanced the forces and created conditions for more transparency to emerge. Also, the mobile phone is allowing producers to overcome some of the main difficulties in livestock production and helping them to trade with more reliability and this can be perceived as another factor supporting resilience.

However, notwithstanding those hints of change, the traditional way of behaving still prevails. For instance, the common practice amongst the Maasai of not putting animals onto the scales because it is claimed that that can help prevent other parties gaining knowledge of the price at which they will sell, and that will prevent thieves from knowing the real value of the transaction and dissuade them from attempts to assault the cattle sellers. The same process (pulling the tail) in the Lake zone is claimed to be more of a practical nature, because it helps producers to overcome the lack of scales in the market. However, both situations keep on pushing aside attempts to modernise the market and enforce LINKS system, a phenomenon that will be explored in the next section.

10.4. Attempts to transform the livestock market: challenges and opportunities for LINKS

LINKS, an ICT-based service, was implemented with the goal of disseminating much needed market information. The service was envisaged as a key resource, addressing longstanding concerns about how to achieve efficient and equitable trading in the livestock sector by collecting and disseminating livestock prices. My study yielded unexpected findings: LINKS is not much used by those producers and in some circumstances, it has brought about even more uncertainty. This partly is due to a weak network signal which means that the server sometimes not issue the response, or to do so only after a long-time delay. This has discouraged many of those who know about the service from using it. Nevertheless, those involved in the development and implementation of LINKS still view the service as functional and as an instrument of change, a sort of "magic bullet".

LINKS was adopted after its implementation in other neighbouring countries, namely Kenya. Notwithstanding some difficulties implementing the service in that country, this was portrayed by some reports in a very optimistic way (Kariuki & Kaitho, 2006). However, in the Tanzanian case, our data show that there were some difficulties not properly addressed: **i)** the implementers failed to consider the pragmatics of trading, and **ii)** ensure that the information would be made available through more than one channel and quickly (voice call would be one good option not only to inform but also to promote the social learning of that service).This may have undermined the aim for the service to become broadly adopted. As our fieldwork highlighted there are some technical problems with LINKS due to **iii)** lack of adequate infrastructure to support its basic functionalities. For instance, the service does not fulfil its most important role of providing price information in a timely and reliable form, and therefore the users in general do not trust that information and do not perceive the service as useful. With regards to this, it has been suggested that the time between the data collection to feed the system and the analyses and dissemination of market prices is too long, with implications upon the real price. The price disseminated on Friday represent the average price of the week, with the information loaded on Monday already outdated. Users suggested that this should be done daily, or in real-time.

10.4.1. Forms of engagement with the livestock market in Arusha region and in the Lake Zone

Those alleged failings suggested a closer look at the role of the mobile phone when the members of the two research groups engage directly with the livestock market and bypassing LINKS. Contrasting the two regions, significant differences in the trade process emerge, not only regarding the reasons assisting the need to trade, but also the methods and the actors involved. Let me start by highlighting Arusha and the Maasai producers. Amongst those producers, selling cattle is intermittent and frequently related to the need to solve a pressing issue. Only in very specific moments and circumstances will they sell for strategic reasons. They rarely use an intermediary to trade for them, preferring to carry out the bargain themselves and thus ensuring that they will obtain the best profit possible. Nevertheless, in some very specific instances, such as after a good *masika (rainy season)* when the cattle are fat due to the availability of grass, they will occasionally trade some of the best cattle using information provided by the *shushushu* (process market information), who are well informed about the market. However, this is the exception rather than the rule.

In the Lake Zone, trade is regular and is used as a strategy to respond to a variety of specific needs. As such, there is real need for the *shushushu* and the *dalali* (promotes cattle and facilitate transport). They will act in concert with the *garagaja* (this is the middlemen strictly speaking). This trade network is more established and is the pattern of the Lake Zone. Looking at the roles of the actors acting in this context it is possible to state that the *garagaja* is the most powerful actor in the market arena, although he acts according to the instructions regarding a minimal price to sell provided by the producer. Normally he advises himself with the *shushushu* and the *dalali* that will help him to trade and ship the cattle. The *dalali* is the third most important actor, after the producer and the *garagaja.* It is common for the *dalali* to contact the lorry man and organise the shipment of the cattle. At the opposite extreme are the *wasuwagaji*, who trek with and conduct the cattle to the market when transportation by lorry is not possible or not desired. Therefore, we can point to radically different forms of interaction with the market, in which the mobile phone comes to play an important role and contributes to reinforcing engagement with the livestock market.

As said previously, independently of the sociotechnical infrastructure, which will determinate a shallow or extended spectrum of appropriation, there is always one given affordance (the first piece of the domino which will generate the chain reaction) disclosed, which will generate a certain degree of appropriation. For instance, in the case of Maasai pastoralist, and taking into consideration that in the vast portion of the territory is not possible to adequately (*unavailability or limited use*) communicate using the mobile phone, which per se does not mean that they are completely out of communication. There will be always a possibility of communication, which represents a potential opportunity for action. The device, even in a shallow context of appropriation, is helping to reinforce key mechanisms of interaction (which includes trust) between key actors involved in the processes of production and trade. The physical presence (explicit or implicit) of the mobile phone can make one be present even though not in the local of action (visible or invisible). The technology suggests that one is communicatively active (availability), which can influence behaviour and make key agencies (bargaining) to fluctuate from one side to another. This represents an unprecedented possibility of action.

The access and transmission of information, independently of the quantity (limitable) and frequency (restrictions), made possible through this device is significant and it is helping the Maasai and the Wasukuma to change their perception of the ontological world where they are immersed. The device brings different levels and opportunities to communicate, which can expand from *restricted* to *unrestricted*, and this is opening avenues for those actors to *micro-coordinate* or to *hyper-coordinate* their activities. As an example, and in what concerns trade, this is helping to increase transparency in trading amongst key players, and consequently allowing greater efficiency, reducing the risk of producers being deceived, thus increasing their profit. Figure 37 captures in diagrammatic form the various actors and their roles, and the dynamics of interaction in those two regions. From that diagram, it is possible to see the degree of complexity and/or simplicity of operations existing is each region. The appropriation, which can be enabled or disabled by cultural practices, is being supplemented by the availability of the sociotechnical infrastructure and the feedback loop between the affordance and the appropriation mechanisms, which is an interactive learning process, as I will explain later.

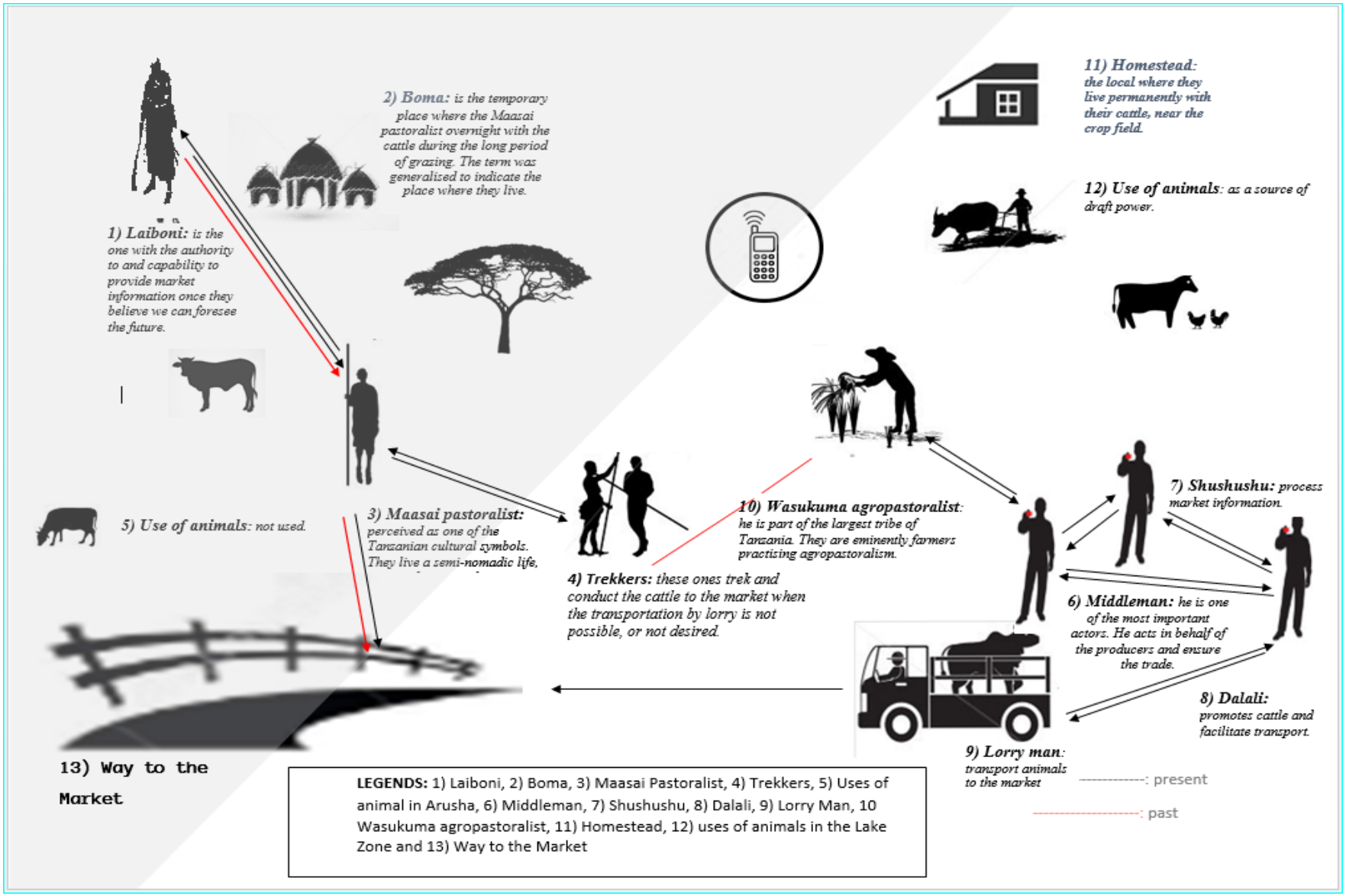

Figure 37- The Actor's World

10.4.2. LINKS deadlock: limited implementation and engagement

Attempts to request information from the LINKS system normally are very frustrating. The server time response is very slow and sometimes it takes hours before a response is generated and provided to the user. This has created a general distrust regarding the usefulness of the system. In contrast, those pastoralists and agro-pastoralists who use the mobile phone (voice call) have more options for accessing privileged information circulating through a small network of family and friends, information which is only shared amongst them. This allows them to establish the reliability of the information, which is something LINKS has not been able to deliver. For instance, family and acquaintances are seen as amongst the most reliable sources of information, echoing Ensminger's perspective when arguing that "*people in small-scale societies might be far more inclined to restrict contractual relations to kin members whom they can trust rather than total strangers*" (1996, p. 28). This offers another opportunity to apply my analytical framework, but in this case in an antagonist perspective. Interpreting LINKS as a part of a large technical infrastructure, I would say that, due to lack of social learning process and deficits in the infrastructure, the users never managed to open the "black box" and make use of a key affordance (easy access to price information), therefore the initial appropriation process did not happen and the subsequent feedback loop did not occur, which would enable further affordances to be disclosed, therefore enabling the appropriation of LINKS.

On contrary, the mobile phone, in this case, emerges working two ways: enabling the micro-coordination of domestic affairs, and to easily search for livestock information amongst the network of friends, as the relationship with and proximity to kin plays large roles in cattle trading in both regions. This help to explain why informal mechanisms tend to prevail. This gives me grounds to claim that the use of mobile phone thus contributes to improving some of the market relations, mainly by facilitating sharing of information (price and conditions for trade) among a restricted number of players, who may gradually constitute a trading community.

10.4.3. How are mobile phones opening avenues for LINKS?

The above gives grounds to stress that the appropriation of the mobile phone has the potential to redress some of the problems encountered by LINKS, which, due to the weak telecommunication infrastructure, does not allow sufficiently rapid capture and circulation of reliable market information, which is the key shortcoming and limits the attractiveness of the service for livestock producers. The latter rarely embrace activities promoted and supported by this service, such as texting more frequently to check or request livestock market prices, and those are the main reasons why LINKS is still in a dead-lock situation. Let me now explain how mobile phones can open avenues for LINKS.

Previous to the upsurge of mobile phones the model of livestock trading was supported by traditional forms of transmitting information; whereby oral communication was the means used to disseminate market prices. The flux of information used to be processed by two channels: **i)** the producers themselves – who used to bring that information from the markets visited in other regions and would disseminate it amongst relatives and friends, within their particular context of production, and those would diffuse that information to other members of the community and spread the information by word of mouth – and **ii)** by middlemen when visiting those regions searching for business opportunities. Therefore, oral communication and the network of friends and relatives has prevailed as the primary source of information, alongside the middlemen, even though the latter are interpreted as a less reliable source of information.

My fieldwork showed that the networks of relatives and friends remain the main source of price information, and the capacity to disseminate that information has been enhanced in terms of speed, frequency quantity and range by the use of mobile phones for voice calls. The mobile allows those actors to rapidly secure price information from reliable sources. For instance, during the fieldwork I witnessed several bargaining processes whereby, before the final price was agreed, the producer phoned a friend or relative in a different market/region and checked the price.

The above system makes LINKS data unnecessary, and not trusted. LINKS is therefore pushed to the fringes: producers who are aware of its existence rarely check the price

using LINKS. Instead they are more likely to call a relative/friend for that information, (exploring the enhanced orality that mobile communication enables). As a result, LINKS use is very low amongst producers in both regions. On this basis, we suggest that the mobile phone offers a key technology to be explored in order to facilitate the *appropriation* of LINKS. Clarifying, the reasons why producers do not use LINKS is referred grounded in the lack of direct interaction with LINKS operators (via a voice call) which would immediately provide price information. Integrating the voice call option would eventually in a second stage encourage users to use the SMS more often to request the same information through LINKS. I would argue that this approach should have been implemented at the initial stage of LINKS implementation. I can see parallels between this and the intensive social learning process that was key to the success of M-Pesa. In the initial stage of implementation, the M-Pesa agents promoted the service and assisted users with all the information needed, providing and accomplishing an important step in the implementation process: i.e. via a social learning approach.

10.5. Competing views of modernisation

10.5.1. Dynamics between the top-down and the bottom-up perspectives

In chapters 6 and 9 some of the critical issues compromising LINKS, which accounts for its relative failure, were described. For instance, LINKS has been conceived by the techno-bureaucratic actors as a top-down technical fix to problems in livestock markets. This approach, embodying an element of deterministic thinking and a linear model of innovation, proved not to be the best course for assisting innovation processes in developing countries. It highlights the problems that can beset attempts to solve specific problems with generic solutions.

Evidence produced by this research suggests that LINKS is not addressing producers' needs. LINKS has not achieved the intended effect due to gaps in the translation process, and due to some socio-political and technical fragilities, such as the lack of

adequate infrastructure, and a deficient social learning process, in a model that corresponds to ICT4D 1.0 conception of dedicated technological solutions as a technical fix. Those were identified as causes undermining the success of the service. This has driven LINKS to an unsuccessful attempt at "*scaling*" (Foster & Heeks, 2013b). Therefore, and similarly to the ICT4D concept, I suggest upgrading the top-down/technical fix from its earlier conceptualisations (which I will call the top-down 1.0.) to a new stage, coherent with the SST MK2, and aligned with Heeks' perspective (ICT4D 2.0), taking as reference his arguments that it is the "technology-in-use […] that has made much more of a difference to people's lives" (Heeks, 2009, p. 5).

Those approaches, which are more grounded in a systematic and qualitative method, and placed at a micro-level dimension, will enhance the opportunities to successfully inquire into and analyse technological innovation and change, which I would define as the top-down 2.0. This strategy will give more opportunity for voices and visions emerging from the users' context to be integrated into an early stage of technology design or policy making, once this study has generate sufficient evidence suggesting, in opposition to Bijker arguments (1987), that the sociotechnical infrastructure to be implemented needed to be interpreted as a multidimensional and complex configuration, i.e. assemblages of heterogeneous social, technical and organisational components as depicted in the analytical framework (please see section 4.7.). Rather, my evidence suggests that users play an active role during the (re) configuration process, by setting particular strategies to open the "black box" of technology and consequently disclosing unanticipated affordances which enables the appropriation mechanism, and this evidence sits comfortably in the development of the SST framework from MK1 to MK2 and the ICT4D 2.0 perspective, which involves recognition of the active role of intermediaries and users in technology use and implementation. Furthermore, this would give both the users and the policy makers the opportunity to learn from each other in an interactive process and generate better conditions for sharing visions and translating languages. This, as conceptually suggested, should enable a resilient system, and therefore create better conditions for users, such as the Maasai and the Wasukuma, to engage and *appropriate* ICTs as effective tools for promoting changes in their socioeconomic life.

I next present a model (figure 38), which I believe opens up a space for a generic understanding of technical change, where I attempt to illustrate the need to shift the classic top-down process of technology development and implementation (Heeks called the invention-down approach) from the vertical (which I have identified as the technical fix), and alternatively suggest the horizontalization of the technological change. Here, I suggest rotating clockwise the force-feeding arrows, bringing the top-down 2.0 (i.e. re-configuration by use) and the bottom-up 2.0 (e.g. use-up) arrows to the induction position. This potentially will spark an innovative and interactive learning process, where the technical fix is socially shaped upon what works, therefore fulfilling users' needs according to the context of use. This is a resonant process and is equivalent to the feedback loop I have been suggesting between the affordance and appropriation mechanisms. This conceptual tool permits aligning the SST MK2 with the ICT4D 2.0 rationale, and this constitutes one of my relevant contributions.

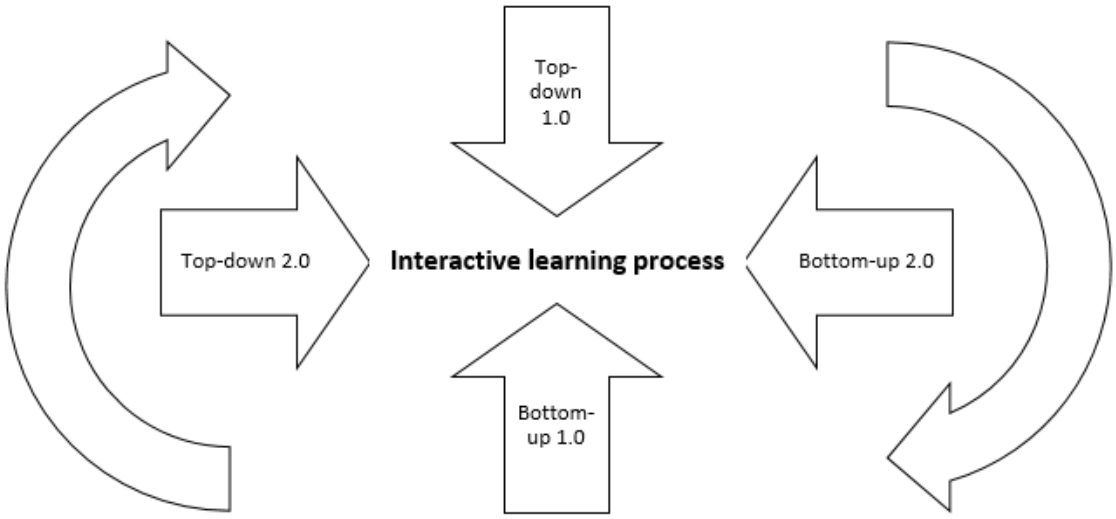

Figure 38: Top-down 1.0 to Bottom-up 2.0 – The horizontalization of the technological change (created by the author)

This gives me reason to believe that my findings are compatible with Williams et al's (2005, p.69) claims, because I am demonstrating that there is a process of reconfiguration in use, which needs to be permanently addressed, mainly in projects running upon the ICT4D perspective.

Users and the context of action requirements needs to be integrated into early stages of innovation processes or technological change, so that they can be aligned with the vision of the change. This will make it easier to decode the technology "blueprint" and therefore to identify the affordances which will automatically enable the appropriation process. My empirical findings provide solid foundation on which I can ground my arguments, and this constitutes an important lesson to be learned, and as well as one of the most important contributions from the research.

10.5.2. ICT4D: the need to reconceptualise the discourse of modernisation

As noted above, when closing the previous section, my findings provided the opportunity to observe and to identify what some authors claim to be the limitations imposed by a non-problematizing of technological progress (Williams & Edge, 1996). This is a prominent lacuna of the ICT4D approach, i.e. difficulties in implementing or translating visions of change into contexts of practice due to lack of assessment of the local capacities to adopt those resources. This generates the 'classic mismatch', as pointed out by Bada (2002, p. 78) who claims that it is important to build "an understanding of the wider and local contextual factors influencing the implementation" because that can facilitate the "adaptation and cultivation of [ICT4D based project]" (Walsham & Sahay, 2006, p. 10).

My case fits into this landscape, where LINKS seems to be an effective resource in the context where it was designed to be used (developed countries). However, in the context where it was adapted (technical fix) it is not working to its full potential. This perhaps reinforces Pacey observation that "to hope for a technical fix (to work] is to pursue an illusion" (Pacey, 1983, p. 10). Many reasons can be pointed out as the root of technical fix failure. They can be due to political, strategic and/or infrastructural handicaps, and amplified by a strategic posture of the users (*interpretative flexibility*), when (not) engaging with the resource. Either way, the recurrent use of inadequate methodologies and strategies to assess and implement ICT4D projects are pointed out by Heeks (2006) as the Achilles Heel of the ICT4D approach, and this is one possible outcome of the lack of assessment of local capacities and user requirements.

As such, I would place LINKS-Tanzania in the realm of those classic failures and point out the absence of a sound strategy to enhance the social learning process as the main reason for that outcome. This argument might be extended to a large portion of 'failed' projects developed according to the ICT4D 1.0 perspective. My research suggests that, in the LINKS-Tanzania case, there is a lack of adequate infrastructure to support the implementation of LINKS in the way it was planned, and this has prevented users, mainly the Maasai, to foresee hypothetical affordances that might be disclosed and made use of. This constitutes a major handicap, once the affordance mechanism is the trigger of the appropriation mechanism, and the possibilities of the sociotechnical context will determine to what extent those affordances can become visible or not. Side by side with this (central question) there is also a lack of strategy to operationalise the service in different ways. This includes operational and communicational synchronisation in coherence within each region's capacities and needs. This has generated inertia in the affordance mechanism which are due to lack of understands regarding LINKS' usefulness. This has increased the producers' reluctance in fully appropriating[108] the service.

In this case I would underline that the policy-making actors should understand the importance of managing those complexities, and develop adequate strategies, to enable users with adequate tools to open the "black box". This is of paramount importance if it to translate science and technology outcomes into the context of use. Policy-makers needs to understand this as an interactive process as proposed by the analytical framework that supports this investigation, that can be used to inform decisions in what respect the implementation of new technologies in society, this being more coherent with conceptualisations inherent to SST MK1 and ICT4D 2.0. This would facilitate new patterns of adoption and innovation supported in the use-up perspective, which could help to tackle major issues affecting people living in developing countries. This constitutes another important lesson to be learned and my relevant contribution concerning the ICT4D narrative, suggesting the need to reconceptualise the discourse of modernisation and technological change in developing countries supported on those approaches.

[108] In contrast, I can point out the appropriation of M-Pesa as a good example of a fully extended appropriation.

10.5.3. The spectrum of appropriation: from shallow to extended

The process of *appropriation* of mobile phones by the Maasai and the Wasukuma emerges as an important determinant of the changes I was able to observe. However, this needs to be analysed with attention to the particularities of each group and the sociotechnical/economic factors of their regions. Therefore, I suggest adding the possibility of a *spectrum* between *shallow* and *extended* according to the sociotechnical characteristics of the context.

Consequently, it is relevant to ask and try to answer who is benefiting more from this technology, and better able to take advantage of the *appropriation*. Our evidence suggests that both groups are taking advantage of mobile phone use, even though it is done in different ways and for different purposes within the same activity of cattle trading. As result, the outcome is different between the two regions. In Arusha the appropriation process, although *shallow*, is allowing the Maasai pastoralists to engage more effectively with the livestock market, by negotiating over prices based on new sources of information which are now supporting the decision-making process. In contrast, the *extended appropriation* taking place in the Lake Zone was due to the superior capability of the sociotechnical infrastructure available in this region. This associated with the innovative character of the Wasukuma made possible for those producers to take the appropriation process much further than the Maasai. The level of complexity and the variety of processes around livestock production and marketing conducted in the region has helped me to illustrate with precision how an interactive process of ICT implementation can be conducted. The existence of an adequate sociotechnical infrastructure and the user willingness, aligned with some effort done in training buyers to use LINKS, has generated an interactive learning process and that enabled a higher number, and specificity (second level) of affordances (e.g. *autonomy, negotiation, collaboration, hyper-coordination*) to be disclosed in this region. Those are far more superior, in number and sophistication, than in Arusha, which stays at a shallow level and just afforded with some generic affordances (e.g. *dependability, bargaining, interacting and micro-coordination*). Consequently, the appropriation in the Lake Zone is not only allowing for some very important processes in livestock production and marketing to be conduct with a different level of complexity, as it is

allowing the region to have an important role in determining important variables of the livestock market, namely when providing market information that allows the setting up of the national price.

Specifically, in what concerns production, it has given the Wasukuma agro-pastoralists opportunities to diversify and adopt a division of labour and functions. They are now able to delegate with more frequency key operations inherent to trading, for instance it is common in this regions for the intermediaries and lorry men to act on behalf of the livestock producers. However, in both cases the appropriation process has enact a more resilient process of production and marketing in both regions, for instance it has made possible the coordinating of the flux of animals arriving at the main markets, and therefore influencing the price, which has a significant impact on the sector at large. Subsequently, the ways in which the *appropriation* of mobile phones has occurred in the two regions (*shallow* and *extended*) has opened up uneven opportunities for both pastoralists and agro-pastoralists.

As I observed, the *appropriation* is allowing the Wasukuma, to benefit from a more elaborated and sophisticated sociotechnical infrastructure supporting collaborative activities, reasons why I classify the process as extended appropriation. This is enabling them to interact in an environment where social capital is richer, thus allowing them to use the mobile phone in a more strategic way when compared to the Maasai, which make possible for them to perceive the context as much richer in possibilities of action (affordance). This give me grounds to claim that trust is more implicit where the device is being appropriated in an extended way and less where the appropriation is shallow due to technical and cultural barriers. The perception of the reality will change according to those two levels of appropriation, mainly because the mobile phone, as a generic communication medium, opens up the opportunity to be readily appropriated by different groups, even those rather marginal to merge into modern system such as *MFarm (2015).* The mobile phone opens up the scope for them to enhance their position in the emerging techno-economic system because its generic function (to talk to someone at a distance in an autonomous way) is its key affordance, and that one, amongst the set of affordances that can be made available by a richer sociotechnical context, is the main catalyser of the appropriation mechanism.

Supported by my findings I have produced a diagram (Figure 39) which aims to illustrate the adoption of mobile phones by those actors. The diagram aims to show the two possible paths promoting and supporting the adoption process, i.e. a more active and sophisticate dynamic adopted by the Wasukuma *(extended-appropriation)*, and a more passive and simple approach used by the Maasai *(shallow-appropriation)*, however both groups are able to contribution to the dynamics of the livestock market through a specific set of affordances (please see chapter 4).

10.5.3.1. Enacting resilience with mobile phone technology

In livestock activity, the decision-making process is key, and in the case of the Maasai and the Wasukuma producers, they needed frequently to make crucial decisions in the context of lack of information, where more resources are needed to support that decision. In this context, the affordances enabled by that technology has brought those actors new possibilities, mainly when enacting resilience.

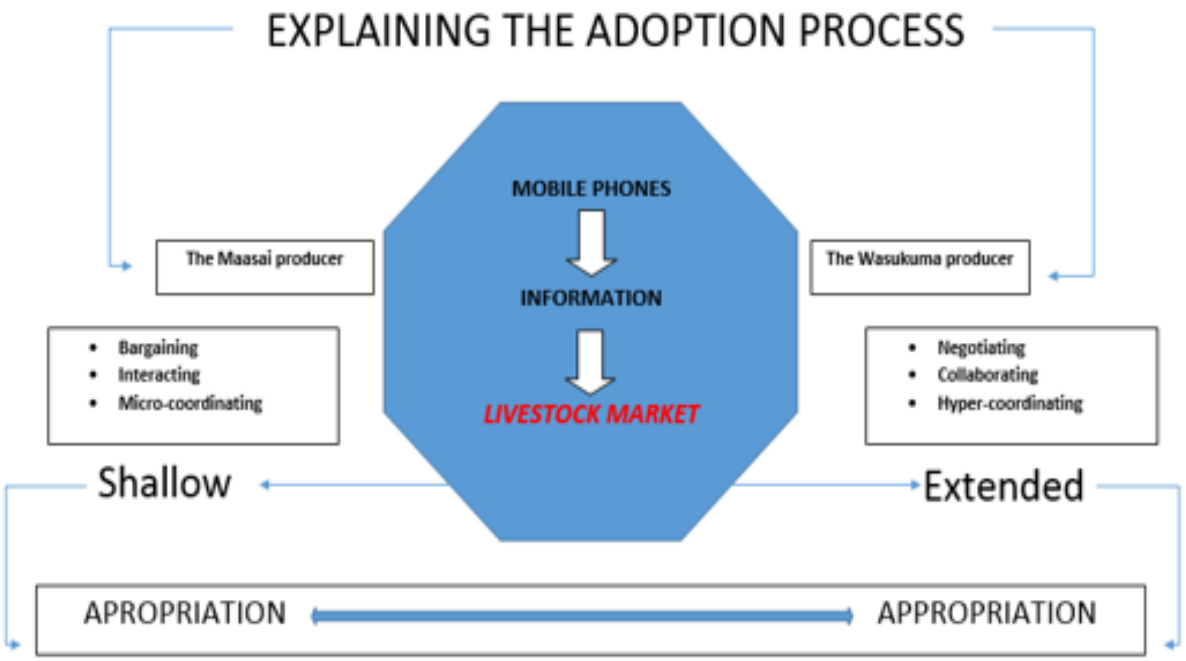

Figure 39: The adoption process (developed by the author)

The *appropriation* (Williams et al., 2005, p. 50) of this device in the day to day life of those actors has generated new alternatives. Producers now can better manage situations of risk where they are vulnerable, and situations of crisis generated by environmental and socioeconomic changes. The *spectrum* is one visible side of this change and it is also measurable in the level and intensity of adoption and use (*shallow & extended*) of basic functions of the mobile phone, such as send and receive information. The device has released more ***autonomy and flexibility,*** and this has enacted the possibility for the Maasai and Wasukuma producers to make decisions with more accuracy, and to modify and readjust the strategy at any moment. This is enhancing the capacity to bounce back and contributing to maintain the resilient character of those people, especially the Maasai.

This is one of the most outstanding changes regarding how the pastoralists interact with the livestock market. The affordances of the mobile phone, as a generic communication device, were exploited through their *appropriation* by producers to meet their particular exigencies. This flexibility in application explains why technology was able to make users more resilient. The ability to communicate at different times, places and settings increases producers' ability to cope with stress, and develop their capacity to adapt, thus enabling expeditious responses to negative impacts. In addition, the device is generating conditions for learning and for increasing capacities, which can be used for future protection. My research supports the idea that the more the technology is appropriated, the more the resilience capability of the user will increase.

10.6. Concluding remarks

Major changes were made in the agricultural sector at the political, administrative and technical levels (research & extension) with overarching aim to change the dynamic of the sector. The Livestock Information Knowledge System (LINKS) was introduced as a solution that promised to increase and improve the operation of the livestock market. It was expected that it would significantly develop the sector, and inherently the quality of life of those cattle producers, and indirectly increase estate revenue aiming to make the country's GDP grow. The evidence presented here suggests that

LINKS was not successful. In contrast, the use of mobile telephones has enacted livestock producers' options for tackling some of their major problems, such as constraints determined by environmental crises, political and economic factors, difficulties over access to land, and the policy of corridors for wildlife. My main argument is that the mobile phone was appropriated differently across the two regions, but in both contexts, it is helping cattle producers to strengthen their position in the livestock chain. The device is generating more options in respect of access to sources of information, and by disclosing more information is helping those producers to make better decisions, to approach the livestock market with more certainty and to conduct the bargaining process with more authority. Therefore, we can conclude that currently in Tanzania the livestock market relations have changed due to the possibility of using the mobile phone. Some of its advantages (autonomy and flexibility) and functions (to receive and make calls and to send messages) are helping producers set up communication more frequently with different markets, buyers and agents.

Mobile technologies are changing some important elements of the regional dynamics. Comparative analysis of those two regions allows further insights. From a macro perspective, the Arusha region lacks sufficient infrastructure to create conditions for actors to *appropriate* the technology further than the *shallow* level. In contrast, in the Lake Zone the mobile phone is being *appropriated* at an *extended* level. For instance, in livestock activities amongst the Maasai, the mobile phone did not disrupt existing conservative practices. On the other hand, and because there has been more awareness and infrastructure in the Lake Zone, the technology adoption there is done in a more sophisticated way, allowing producers to use the mobile phone in more innovative ways and at different stages in the production and trade activities. Consequently, it is possible to observe that the mobile phone emerges as a more inclusive technology, mainly when compared to a computer with internet access. The device yields greater benefit mainly to those where the *appropriation* can be done in a more extended way. This study has observed not only that more extensive appropriation was achieved amongst actors with more effective knowledge and infrastructure support but also that this had more far-reaching effects amongst those actors with stronger social capital linkages and institutions (an observation that may have wider pertinence), and this is allowing for some important differentiations between those two communities.

As a result, it is possible to argue that the mobile phone is critical to help the Maasai and Wasukuma producers manage herds, because it emerges as related to purpose, variation, and capability building. Therefore, I can emphasize that the life of those pastoralists has been positively reshaped by this device, which, as an accessible and generic communication medium, was very readily appropriated by those producers for different purposes in a process that I classify as *shallow and extended appropriation* which has allowed for THE SOCIOTECHNICAL TRANSFORMATION OF THE LIVESTOCK MARKET IN TANZANIA.

10.6.1. Limitations and future research

Conducting this research in Africa opened many challenges. For instance, the research process was affected by the scarcity of resources, requiring me to make key decisions about the duration of the fieldwork and the geographical context to be explored. Also, I had to deal with the issue of risk: should I expose myself to the dangerous situations that unfortunately characterise some African countries, such as where this research was meant to take place initially. Kenya had hazardous situations, such as terrorist activities of the Somalian terrorist group Al-Shabaab. In addition, how would I deal with issues of access to key informants and overcome the language barrier? Swahili is the official language, even though English is very commonly spoken. It was prudent to follow the transition board panel recommendations suggesting that I base the study in one rather than the two countries and undertake a regional comparative analysis (microstudy) instead. I acknowledge that the outcome of this research is in part due to those helpful recommendations.

Struggling with those and other decisions suggested that I should be very judicious when making my options regarding the trade-off between depth and breadth (and between micro/macro-scale study) which would involve more or fewer participants, and different methods of data collection. After reviewing possibilities, I concluded that it would be better to settle the study just in Tanzania and embrace a more realistic journey, conducting the research as a microscale study, and engaging in the everyday life of the Maasai and Wasukuma pastoralists.

Reflecting now on those issues, I recognise that the decision to conduct the research just in Tanzania brought significant benefits. It gave me the opportunity to become immersed in that context and enabled me very quickly to learn what to do and what not to do when trying to get involved with the livestock market dynamics. This opened the door to many sources of information from people who, though knowing about my researcher status, welcomed me and made available complementary research resources, such as becoming research assistants and/or interpreters during my journeys throughout Tanzania. This, from the methodological point of view, enabled a more micro analytical perspective, which trigged the opportunity for an in-depth and intensive observation and study of mobile phone uptake by the Maasai and Wasukuma

livestock producers, centring attention on how those actors appropriated the mobile phone to overcome livestock production and marketing constraints. I engaged with a relatively large set of producers and markets within these regions. Choosing this middle-range focus rather than focusing on one or two groups, which might have constituted a limitation and prevented a close look at those actor's day to day, was beneficial because it forced me to use different methods of data collection. An alternative approach might have focused on national players (political-bureaucratic actors), which would have increased the risk of reproducing only the official view of ICT4D, and probably classifying the implementation of LINKS in a very optimistic manner, as pointed out by relevant literature (Kariuki & Kaitho, 2006) which, as I believe having proved, is not the case.

As I have said earlier, those recommendations positively affected the way I managed my resources and the time available to visit a significant number of livestock markets across the country, collecting a substantial amount of qualitative data through semi-structured interviews and participant observation. This made the fieldwork an intensive but a rich process of data collection. As a result, this study has avoided an important factor that would work as bias, namely, interpreting the system heavily grounded in viewpoints from the political-bureaucratic arena to analyse the attempt to implement LINKS, far from the context of mobile phone use. This would have prevented the findings which I did obtain.

Nonetheless, the data collected does not allow some other important claims to be made. For instance, it would be very good to undertake further ethnographic study within Tanzania regarding producers that do not own/use the mobile phone for trading, which would allow for further triangulation to be done. More particularly there is scope for a sociology of markets to be undertaken in the livestock market in Tanzania, because this as emerged as a central aspect of my empirical journey which it was not possible to anticipate, otherwise I would have designed the research with that in mind, with revised conceptualisation.

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APPENDICES

Appendix 1

OPERATIONALISING RQ 1 AND 2

Main Research Question:

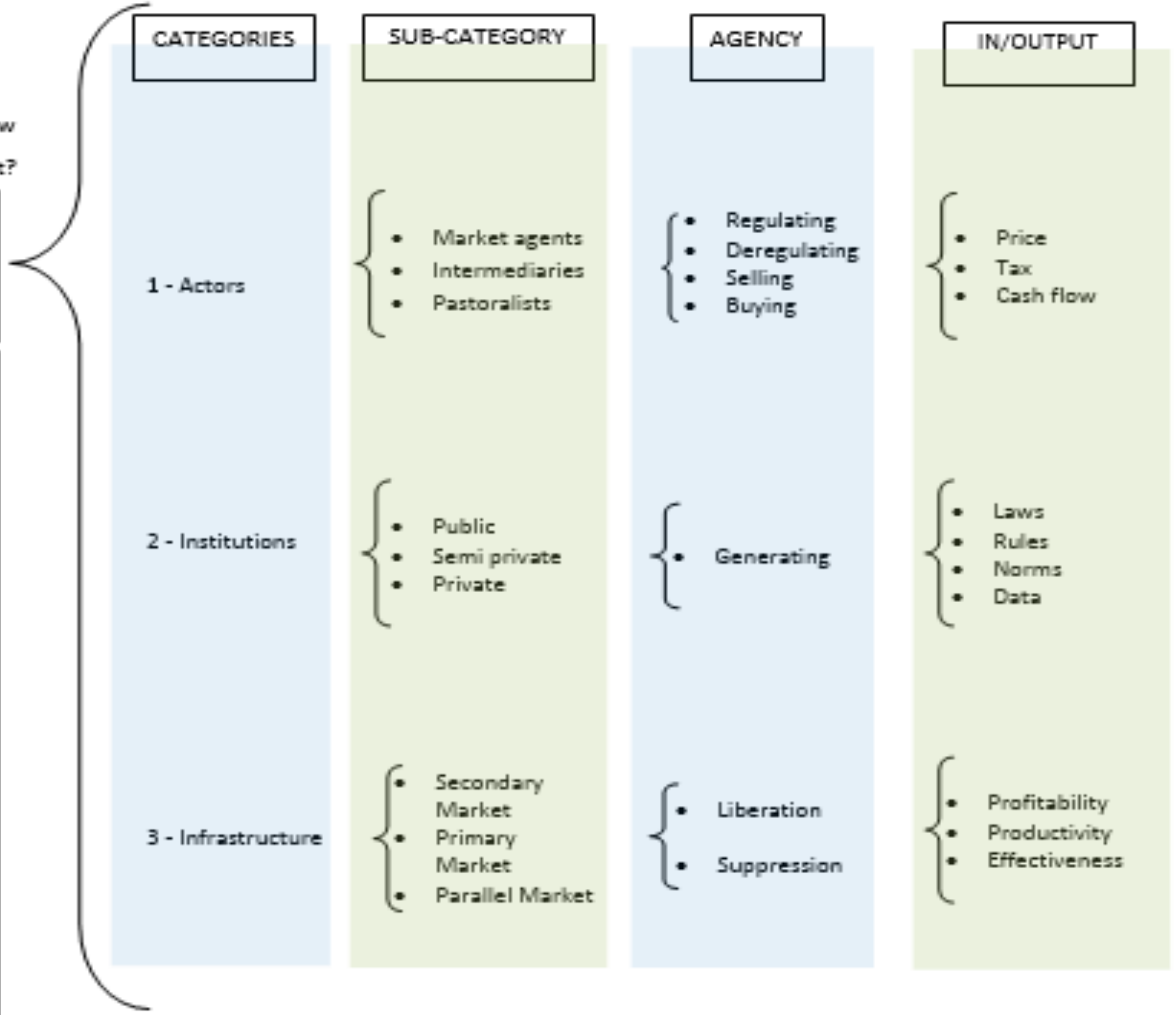
To what extent is the appropriation of mobile phones changing pastoral lives and how pastoralists interact with the live stock market?

Coding paradigma:

RQ i &ii – i) what are these changes, ii) is this change affecting the activity or the way of life?

Answering these research questions will allow me to set up my analysis upon the process of change as one possible result of the adoption and domestication of this technology. The changing process need to be reported by key actors, to whom I will ask to describe which are the perceived transformations in relation to the three main constituents of the market structure - actors, institution and infrastructure (Cat. 1, 2 & 3):

- Q1: CAN YOU TELL AND DESCRIBE WHAT HAS CHANGED IN RELATION TO HOW THE PASTORALISTS USED TO APPROACH THE MARKET?
- Q2: IS THIS "NEW WAY OF DOING" AFFECTING THE RELATION WITH THE MARKET STRUCTURE, THE WAY THEY CONDUCT PASTORALISM AND THE WAY THEY LIVE?
- Q3: IS THIS "NEW WAY OF DOING" BRINGING OR TAKING CATTLE TO MARKET?
- Q4: DO YOU THINK THESE TRANSFORMATIONS ARE THE DIRECT CONSEQUENCE OF THE MOBILE PHONE USE, OR THERE ARE ANY OTHER FACTORS INTERCONNECTED?



Appendix 2

OPERATIONALISING RQ 3 AND 4

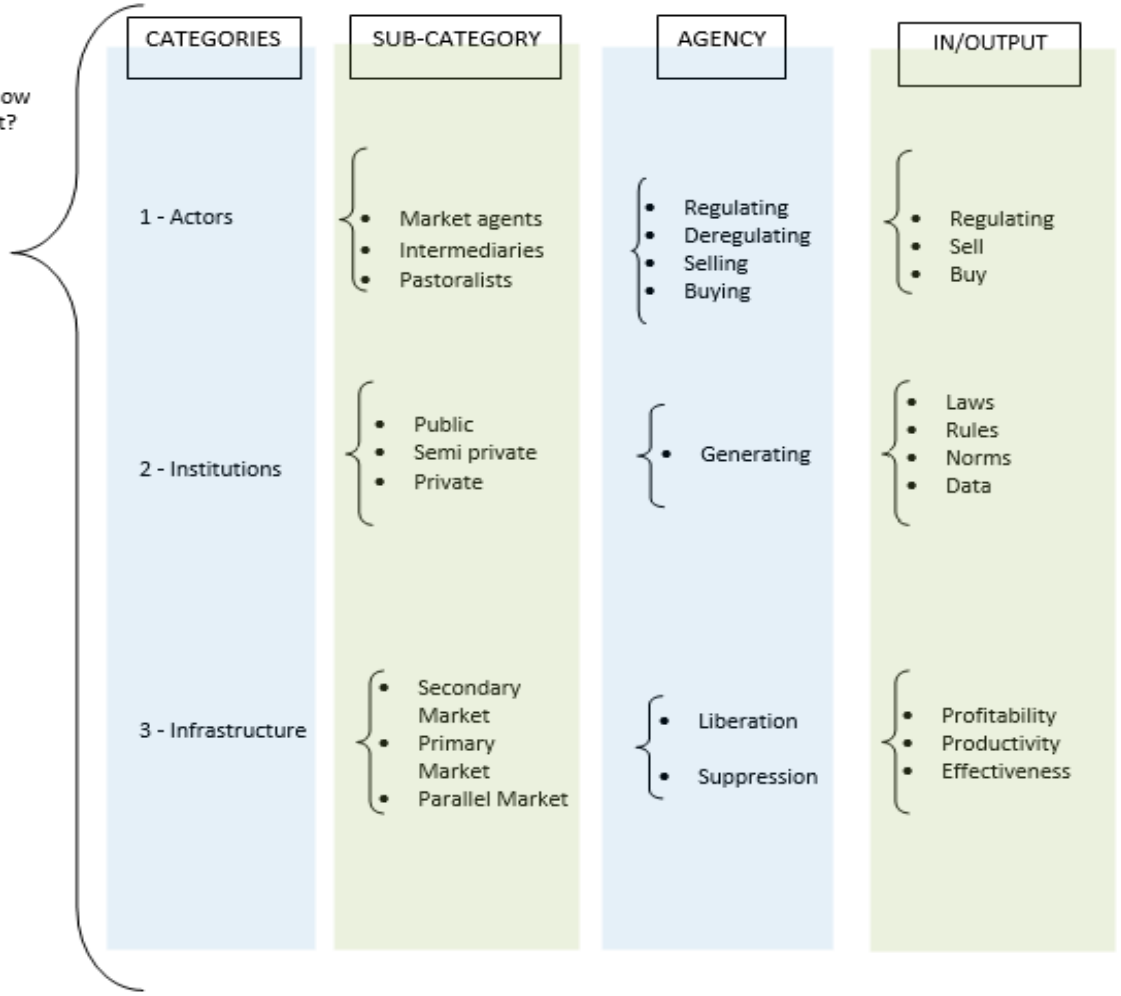
Main Research Question:
To what extent is the appropriation of mobile phones changing pastorals lives and how pastoralists interact with the live stock market?

Coding paradigma:

RQ iii & iv -Who are the actors within the livestock market; which role they play?

This research questions aims to help me indentify who is who within the livestock market. By questioning this I will try to build evidences about the role those actors are playing, where their intervention is more relevant and why. I will also try also to understand if the use of mobile phones are relevant in the role played, trying to compare with a period where the use of this device was not so effective:

- Q1: CAN YOU TELL ME WHO ARE THE PEOPLE INVOLVED IN THE MARKE?
- Q2: WHICH ROLE THEY PLAY AND WAY IT IS IMPORTANT?
- Q3: WHICH ROLE DO YOU THINK MOBILE PHONES ARE PLAYING IN THIS PROCESS, CAN YOU GIVE ME EXAMPLES?
- Q4: CAN YOU CONTARAST THAT EXAMPLE WITH A PERIOD WHERE THE USE OF MOBILE WAS NOT SO RELEVANT?



Appendix 3

OPERATIONALISING RQ 5 AND 6

Main Research Question:
To what extent is the appropriation of mobile phones changing pastoral lives and how pastoralists interact with the live stock market?

Coding paradigma:

RQ v & vi - how can we best characterize the role of the infrastructure/technology supporting the interaction, and with which consequences?

This research questions aims to explore the role of LINKS in this process, and how, with the complementarity of mobile phones, it is generating an alternative for the pastoralist to approach the market with relevant information , that promotes choice and decision in a more accurate perspective, trying to deepen and understand which are the consequences of this option:

- Q1: CAN YOU TELL ME HOW RELEVANT IS THE DATA MADE AVAILABLE BY LINKS?
- Q2: HOW IS THIS OPTION AFFECTING THE CHOICE AND DECISION ABOUT WHICH MARKET TO GO?
- Q3: DO YOU THINK THIS IS BRINGING ANY ALTERATION,
- Q4: HOW IT AFFECT PASTORALISM AND THE LIFE OF PASTOTALIST

CATEGORIES	SUB-CATEGORY	AGENCY	IN/OUTPUT
1 - Actors	• Market agents • Intermediaries • Pastoralists	• Regulating • Deregulating • Selling • Buying	• Regulating • Sell • Buy
2 - Institutions	• Public • Semi private • Private	• Generating	• Laws • Rules • Norms • Data
3 - Infrastructure	• Secondary Market • Primary Market • Parallel Market	• Liberation • Suppression	• Profitability • Productivity • Effectiveness

Appendix 4

List of Interviews						
Interview N.	**Date**	**Name**	**Institutions**	**Role**	**Place**	**Obs**
1	24.06.2014	John Chassama	Ministry of Industry,Trade and Marketing (MITM)	LINKS Coordinator	Dar Es Salaam	This was a relevant interview not only to collect intial information but as well as to to prepare data collection.
2	24.06.2014	Mr Manumbu	Ministry of Industry,Trade and Marketing (MITM)	Assistant Director, Dep. of Marketing, Information and Research	Dar es Salaam	Mr Manumbu was a key informant, being involved in all the stages of the Livestock Marketing transformation. We worked in all of Ministries where the sector was integrated. He took part in the process of implementation of LINKS systems, which has replaced the previous mechnism of data collection, analyses and dessimination of livestock marketing information, supported in the Symfony software.
3	27.06.2014	Mr Mareka (Eng.)	The University of Dar es Salaam	Coordinator of the Computing Centre and LINKS server mononitor	Dar es Salaam	From this interview we build our understand regarding LINKS architecture and how the data is collected, manipulated and made available through the server. We had also opportunity to learn about the Internet service in Tanzania.
4	28.06.2014	Samuel Olé Kimais	_	Maasai individual working in DSM as night watchman	In the way to Mvomero Market - Morogoro	With this interview we gain understanding regarding alternative sources of livelihood embraced by the Maasai livestock keeper when facing crises brought about a set of factors which inpinges negatevelly on livestock production.
5	28.06.2014	Philemen Olé Saipi And Masike Shomi	Maasai pastoralists	Producer	Mvomero Market - Morogoro	Collecting data regarding livestock activity and livelihood strategies.
6	28.06.2014	Mr Rupindo	Livestock market structure	LINKS Market Monitor and Livestock Officer	Mvomero Market	Collecting data regarding the livestock market activity and dynamics.
7	03.07.2014	Jackson Kerritty	Livestock market structure	LINKS Market Monitor and Livestock Officer	Iringa Market	Collecting data regarding the livestock market activity and dynamics.
8	03.07.2014	Dotto Kidole	Maasai pastoralist	Producer	Iringa Market	Collecting data regarding livestock activity and livelihood strategies.

9	03.07.2014	Machau Kochocho	Maasai pastoralist	Producer	Iringa Market	Collecting data regarding livestock activity and livelihood strategies.
10	07.07.2014	Aron Luziga	Ministry of Livestock and Fisherie Development	Assistant Director Livestock Infrastructure Development and Marketing	Dar es Salaam	Relevant actor at the level of policy making arena. Gave us an very important insights regarding livestock industry trends and the future of pastoralism in Tanzania.
11	08.07.2014	Rajabu Nkalange	Ministry of Agriculture Food Securit and Cooperatives	Agriculture Officer, Extension Services – Training and Dissemination	Dar es Salaam	From this interview we got acquainted with issue surrounding Extension Services and the work done by those technicians, namelly when strengthening links between practical (local) and formal (global) knowledge.
12	11.07.2014	Mr Baraka	Livestock market structure	LINKS Market Monitor and Livestock Officer	Dodoma	Collecting data regarding the livestock market activity and dynamics.
13	11.07.2014	Mr Kilunga	Livestock market structure	KizotaHolding Ground Manager	Dodoma	Collecting data regarding the livestock market activity and dynamics.
14	11.07.2014	Nashoni	Trade community	Trader	KizotaHolding Ground Dodoma	Collecting information in order to build knowledge on the buyers side.
15	11.07.2014	John	Trader comunity	Trader	KizotaHolding Ground Dodoma	Collecting information in order to build knowledge on the buyers side.
16	11.07.2014	Aruna	Trade community	Trader	KizotaHolding Ground Dodoma	Collecting information in order to build knowledge on the buyers side.
17	11.07.2014	Ivan Boniface	Middlemen	Trader	KizotaHolding Ground– Dodoma	Collecting information in order to build knowledge on the buyers side.
18	11.07.2014	Mr Albarat	Middlemen	Trader	KizotaHolding Ground – Dodoma	Collecting information in order to build knowledge on the buyers side.
19	15.07.2014	Egbert Shasha	Livestock market structure	Zoo Sanatarian Inspector	Pugu Market – DSM	This actor gave us a very interesting perspective regarding the assessment perspective .
20	15.07.2014	Charles kazuka	Livestock market structure	Trader	Pugu Market – DSM	Collecting information in order to build knowledge on the buyers side.
21	15.07.2014	Ramadam Athuman	Trade community	Agent	Pugu Market – DSM	This agent gave us some important information regarding how the daily price of the cattle is settled between the final and the locals markets.
22	15.07.2014	P1:Said Hamis, P2:Mwando Makenze,	Trade community	Traders	Pugu Market – DSM	This was an interesting collective interview with 4 traders from different regions (P1: Dodoma, P2 and 4: Shinyanga and P3: Tabora). From this interview, it was possible to learn a little bit more about the dynamics of trading using the mobile phone and the changes brought about by this device.

		P3:Majaliwa Said, P4:Mabula Ngiri				Those traders normally will purchase cattle in the primary and secondary markets in those regions and bring to Pugu (final market) to trade. Often they use the mobile to negotiate and to request the agent in the regions to sent more cattle.
23	27.07.2014	Mr Edward	Telecommunication sector	Engenier	Shinyanga – Lake Zone	This was an actor who has worked in the telecommunication sector for decades. He described the process of technological transformation from the period of landline phones to mobile phones, point out the changes this has promoted in the society at large.
24	28.07.2014	Jifungo	Trade community	Middlemen	Shinyanga – Lake Zone	We used a different methodology when conducting this interview. We decide to follow just one actor throughout a market day. This would give us chance to better focus on particular strategies used to overcome struggle to trade cattle in primary markets, mainly when not having a mobile phone to comunicate.
25	28.07.2014	Mr Shehe Mganga	Livestock market structure	LINKS Market Monitor and Livestock Officer	Shinyanga – Lake Zone	Collecting data regarding the livestock market activity and dynamics.
26	29.07.2014	Kasinge Tangu	Wasukuma agro-pastoralist	Producer	Tinde - Shinyanga – Lake Zone	Collecting data regarding livestock activity and livelihood strategies.
27	29.07.2014	Nhuba Njile	Trade community	Garagaja/Dalali	Tinde- Shinyanga – Lake Zone	This is one of the traditional actor taking part in the network of actors participating trading cattle in the Lake Zone. This participant plays the two roles the middlemen and the informant. However, this normally is done by different individuals.
28	29.07.2014	Juma Mwando	Trade community	Dalali (informant/ transport facilatator)	Tinde- Shinyanga – Lake Zone	Collecting data regarding trading activity and the new dynamics brought about the mobile phone in what regards the coordination of transports.
29	29.07.2014	Leonard Magembe	Local Governement menber	Ward Executive Officer	Tinde- Shinyanga – Lake Zone	A broad interview covering several aspects regarding not only the livestock activity but as weel as the changes at the level of the civil services and public administration.
30	29.07.2014	Mr Limbu	Livestock market structure	District Marketing Officer and LINKS market monitor	Tinde- Shinyanga – Lake Zone	Collecting data regarding the livestock market activity and dynamics
31	31.07.2014	Makoye Kaziro	Trade community	Trader	Nyamongolo	Collecting information in order to build knowledge on the buyers side in this region
32	31.07.2014	George Kamuli	Trade community	Middlemen	Nyamongolo – Lake Zone	Collecting data regarding trading activity and the new dynamics brought about the mobile phone.
33	31.07.2014	Sakiri Yunge	Service provider	Wasuwagaji (trekker)	Nyamongolo – Lake Zone	Those actors brougth a new perspective of the trading activities. They gave us a panorama of the challenges they face when trekking cattle to the market anfd how the mobile phones are helping them to cope with those challenges.
34	31.07.2014	Josuwa R. Machage	Independent Bodies	Chairman Mwanza City Butcheries Association	Nyamongolo – Lake Zone	This was an interesting interview to gain perception on the dynamics in the livestock value chains (such as the processing and transformative sectors) where the quality of the cattle plays an important role.

35	02.08.2014	Salin Ylambambasa	Paralel bussiness:	Mobile phone charger/repairer	Senani – Lake Zone	This was a very important interview, mainly because most of the mobile phones repairers do not like to talk about what they do. Nevertheless, from this interview we could, even if very superficially, understand how mobile phones are helping people to build new forms of livelihood; for instance, there are now two very common activities that can be found within the livestock market: the mobile phone charger and mobile phone repairer. Those two activities are giving some people the opportunity to generate a complementary source of income and reinforce the household revenue.
36	02.08.2014	Mboje Lukomanya	Service provider	Wasuwagaji (trekker)	Senani – Lake Zone	Exploratory interviews with the wasuwagaji gave the opportunity to gain solid understanding regarding the importance of the mobile phone for those actors, namely how they manage issues of hazard and security during the trekking of the cattle. For instance, recovering lost cattle is now easier which is building the perception that they are better rewarded.
37	02.08.2014	Ndebile Ngese	Service provider	Wasuwagaji (trekker)	Senani – Lake Zone	In this interview, an important aspect of the microcoordination of the household was pointed out as one of the relevant aspects that the mobile phone has made possible. These actors can now contact the family or friends during the long hours of trekking, and inform them about any issues, and as well as, send or request money via Mpesa.
38	02.08.2014	Sita Gagala	Service provider	Wasuwagaji (trekker)	Senani – Lake Zone	Another relevant aspect (affordance) of the mobile phone was disclosed during this interview. One of the technical features of the mobile phone is givin the trekkers the change to manage one critical situation. For instance, during the night it is frequent they being persuid by woild animals, such hienes. Those case the torch inbuilt in the device is very usefull to dissuade those animals. Another relevant aspect (affordance) of the mobile phone was disclosed during this interview. One of the technical features of the mobile phone is giving the trekkers the chance to manage one critical situation. For instance, during the night it is frequent they being pursued by wild animals, such as hyenas. In those cases, the torch inbuilt in the device is very useful to dissuade those animals. Also, the chance to avoid people with bad intentions was flagged-up as another possibility brought about this device.
39	03.08.2014	Macele Yoana	Wasukuma pastoralist	Producer	Shanwa – Lake Zone	This story gave us the opportunity to understand how different the dynamics of production are in between the two regions. For instance, in this interview, it was flagged one of the strategies used to increase the quality of the herd. Pastoralists in this regions, in general, they attempt to purchase in a very specific way. In this case, this pastoralist was trying to buy cattle (heifer) to ensure good quality when reproducing.
40	03.08.2014	Fabian Richard	Wasukuma pastoralist	Producer	Shanwa – Lake Zone	Some aspects inherent to dislocating cattle from the homestead to the market were discribed in this interview. The coordination of some important tasks in that process was suggested now being easier to control.
41	03.08.2014	Pauline Sene	Trade community	Trader	Shanwa – Lake Zone	From this interview, it was possible to learn a little bit more regarding the dynamics of local trade and the importance of having reliable information in

						hands to make a good decision. It was illustrated the role played by mobile phones in this process.
42	03.08.2014	Musa Raphael	Trade community	Trader	Shanwa – Lake Zone	Again, in this interview some of the aspects of coordination of the cattle during the trekking to the market were flagged-up, namely in which circumstances the trekker can sell the cattle before arriving at the destination market, aiming to minimise loss of profit.
43	03.08.2014	Samuel Gunda	Service provider	Wasuwagaji (trekker)	Shanwa – Lake Zone	Some more important aspects of the microcoordination of the household during the trekking. Also, the chances to increase the volume of bussiness were pointed out in this intervew some of the relevant aspects that the mobile phone has made possible.
44	04.08.2014	Simon Nyagawa	Livestock market structure	Marketing Officer and LINKS market monitor	Maswa – Lake Zone-	This relevant actor gave us some insight of the panorama regarding the absence of LINKS from the trade community. He also pointed out the lack of infrastructures, such as scales, to make the livestock market become more formal.
45	05.08.2014	Limbu	Service provider	Wasuwagaji (trekker)	Bariadi	With this interview tried to explore further the importance of the mobile during the trekking.
46	05.08.2014	John Duba	Trade community	Middlemen	Bariadi	Tried to explore further the dynamics of trading with Kenyan livestock traders
47	05.08.2014	Ntunga Sanson	Trade community	Middlemen	Bariadi	This trader gave us the perspective that mobile phones are creating conditions for the existence of a parallel market, and that the use of the device is allowing for the best animals to be taken from the formal market.
48	13.08.2014	Raphael Manogoi	Maasai pastoralist	Producer	Malambo – Ngorongoro, Arusha region	The market where thisinterview was done in locate in a very isolate place in the vast plain of Ngorongoro division. Our interviewd gave us the prespective of the importance of have now better ways of deal od issues of distance, namely how the relation distance-price ins managed. The mobile phone was poinded as critical to help them deicde which market to go. I t was also pointed out the importance of mobile phones is sending and receiving money.
49	13.08.2014	Ester Jakob	Maasai pastoralist	Producer	Malambo – Ngorongoro, Arusha region	This was one of the few womem we saw trading in the livestock market, which traditionaly is a male arena. Ester gave us one of the most interesing interview we were able to conduct, namely how she manage to challenge some very grounded cultural rules, emphasizing that that was in part possible due to the use of the mobile phone which has empowered her when giving access to more information.
50	15.08.2014	Saringe Rago	Laiboni of Maalone Village	Community leader	Maalone village – Ngorongoro, Arusha region	Side by side with the interview done to Ester, the interview with the Laiboni, which is a sort of prophet/leader of the community, is a relevant aspect of our fieldwork once normally it is very hard to gain access to such actors. This Laiboni gave us the perspective of the importance of the technology (mobile phone) in helping them to make their culture to prevail within the changing world.
51	20.08.2014	Lucas Mwalongo	Deputy Director, Tanzania Communication	Regulators	DSM	This interview covers issue of regulation of the telecommunication sector in Tanzania. It brings some keynotes regarding the chronology of the creation of Tanzanian Communication Regulatory Authority. The interview also brings to the surface issues of market strategy at micro and macro levels.

			Regulatory Authority			
52	21.08.2014	Albert Maneno	Head of Revenue and Marketing Planning – Vodacom Tanzania	Telecommunication – Private sector	DSM	This interview highlights key aspects of the telecommunications sector, mainly in what regards some strategies to try fill in the gap between urban and rural areas concerning the implementation of basilar infrastructure and the governmental encouragement for the private operators to decentralise services and products to rural areas.
53	26.08.2014	Mr Mlinga	Livestock market structure	Livestock Field Officer at Mesarani MK	Mesarani - Monduli, Arusha region	This interview corresponds to a vision of the market from the perspective of the central government (CG). It is emphasied the attempts done by the CG to modernize the sector and the rejection of the users to embrace that change.
54	26.08.2014	Mr Mollel	Trade community	Middlemen	This interview illustrates a cha	This interview illustrates a change of o livelihhod strategy. This actor used to be a pastoralist. But after having lost almost all is cattle, due to a severe drought, he decide to become a middlem.
55	28.08.2014	Mr Maulid	Trade community	Dalali (informant/ transport facilatator)	Mesarani - Monduli, Arusha region	This actor gave us the perspective of the Arusha region in what regards transportation options and how the mobile phone is helping them to cope with demand and challenges of transporting cattle from the market to the abattoir or to other markets.
56	27.08.2014	Choby Chubwa	Ministry of Livestock and Fisherie Development	Ngorongoro District Veterinary Officer	Arusha City	This was a very broad interview, covering topics from marketing, livelihoods and animal health perspectives. Central to those issue is the use of mobile phone, and how the device is being change some relevant dynamics in Arusha region, namenly in Ngorongoro division where the Maasai inhabit. Important aspects such the management of natural resoucers and the introduction of the policy of the corridors were flagged-up.
57	28.08.2014	Dr Emmanuel Manassen	Education secto - Nelson Mandela Instituion for Science and Technology	Lecturer of Electronics and Communication	Arusha City	From this interview, we managed to gain an understanding of some of the technical issue surrounding the infrastructure to support mobile communications. Also, it was possible to understand how the Institute for STS is set up, and which are the expectation emerging from this field in Tanzania.

Appendix 5

Discription of the markets visited

- **Pugu Market - Dar es Salaam**

Pugu is the most important livestock markets in Tanzania, it is the final market and the destination of the large majority of the livestock produced across the country. This market also integrates LINKS network of monitored markets. Pugu operates all year long, from Sunday to Monday. The majority of the cattle traded in the country are shipped daily to this market, making Pugu to be the reference. This market is frequented mainly by traders, coming from all over the country to search for business opportunity. This is the prime arena for agents and intermediaries operating in the capital. From Pugu they negotiate the reference price at the national level. The market is not too far from the city centre, around 20km, however and due to the intense traffic in DSM, sometimes it can be quite complicated to reach the market quickly, and this brings attached negative impacts to traders. Pugu is constituted by two arenas: from the main entrance towards the left-hand side we will find the cattle market, which occupies around 2/3 of the total size, and to the right-hand side the sheep and goats market, occupying the remaining 1/3 of the total space. By the time, we visited the market it had had recent improvements, and some equipment had to be installed in the market, namely the auction area, side by side with the installation of an electric scale. However, both the auction area and scales are not in use, once it is not regular the practice of the auctions or to weight animals. There are two loading ramps and two holding yards. The administrative and sanitarian block complement the set of facilities existing in Pugu. As said above, the electric scales are not in use because actors prefer

to bargain based on the aesthetic assessment, which is complement with the action of pulling the cattle tail to find out the weight.

Inside the market, there is more than one retail activity: there is the market for forage, market for clothes, a market for electronic equipment and mobile phones, shoe repairs, restaurants and other small retail activities. Among that large universe of traders, we will find the boy (called *machinga*) who sold cigarettes and sweets per unit (*reja reja*). We can also find women selling tomatoes, cassava or sweet potatoes in small piles of 500, 1000, 2000 TSH, creating an atmosphere of a bazaar (Geertz, 1963, p. 32), which is typically found in informal rural and peri-urban markets. Similarly, to all the other livestock markets we visited, it is also possible to find the mobile phones (*fundi simo*) or bicycle repairers (*fundi baisikeli*). Four interviews were done in this market, being one of them collective with four livestock traders who explained the importance of the mobile phone in their activity. We did eight interviews in this market.

- **Kizota market – Dodoma**

Kizota is a secondary market, which means that it is under the central government supervision. The market has modern equipment (holding pens, auction area, scales and a slaughter slab, and adequate administrative facilities whit sanitarian blocks. There are evidences supporting the idea, or attempts, to set up the marketing activity in a more formal/technical way. However, and as we were able to observe, the trade is carried out in a more traditional and "closed" manner, with the middleman ensuring the liaison between keeper and buyer, even though in some circumstances there is just 20 Mt separating the two. The bargaining process is led by the middlemen, which is a sort of expert that holds the practical and tacit knowledge to visually and manually (pull the tail) assess the animal, resorting to this in an implicit authority to place the final price and conclude the transaction. Apart from that, Kizota, side by side with Weruweru (Moshi-Kilimanjaro) and Mesarani (Monduli-Arusha), plays an important role in the livestock markets network, once the majority of the cattle that circulates in the Tanzania mainland, pass by those markets. The market is managed as a holding ground, and it feeds the Dodoma abattoir, which is one of the most important at the national level; and the final market (Pugu, DSM). Regardless of the holding ground concept being a relevant practice, as a means to improve animal health and the standard of quality within any livestock market chain, the practice is not perceived as

compulsory and therefore not carried out. Nevertheless, this is one of the most modern and well-equipped markets we visited and where we had the chance to conducted five interviews. One of them was collective with three pastoralists. We did eight interviews in this market.

- **Seke (Shinyanga- Lake Zone)**

This is a small primary market placed 50 Km north in direction to Mwanza. The market corresponds to a small portion of land, lacking the entire basic infrastructure that could help to classify it as a livestock infrastructure. The place is visited mainly by the Wasukuma people that practice agriculture in parallel with livestock keeping. In this market, and since the activity was not to intense, our strategy was to choose just one participant and follow him throughout the day: from the arriving until he had sold all the animals. The strategy aimed to understand some of the dynamics inherent to livestock trade, namely the bargaining process. As such, the research activity in this market resort in one interview and to a long period of observation.

- **Tinde (Shinyanga –Lake Zone)**

Tinde is a well-organized primary market, which puts into practice some of the measures suggested by the Central Government as necessary to improve cattle standard of quality. Among them, the imposition to undertake prophylactic measures (dip the cattle) after the trade is being done and before the cattle leave the market in direction to other regions. This means that the market is equipped with a functional dipping tank; parallel it has the traditional holding pens which forms the auction arena. This innovative way of behaving in Tinde is expressed not only in the obligation to dip the cattle, but also through the imperativeness, of all middlemen to be registered in order to trade within the livestock market. It was the only market where we found this as a regulated practice, being this a critical option to help change the way business is being conducted, shifting from a more traditional and informal (closed) to a more innovative and formal (open), which is helping the Local Government to enforce god practices and to generate more revenue. Those are relevant facts, which helps to

explain the innovative character[109] of the local authorities, mainly the Ward Officer Executive, with who I had the change to expend a substantial slice of the research time expended in Tinde, and who would concede us an interesting interview to close the fieldwork journey in this market. We did five interviews in this market.

- **Nyamhongolo (Mwanza)**

This market could be classified as a ghost market, once in theory it should already have been deactivated, but in practice it is still operating and trading animals. Therefore, it was complicate to gain access in order to collect information. To do so we had to visit the City Livestock and Fishery Office, and talk to the City Officer, and after that we were sent to talk to the Regional Livestock Officer, before we were granted with permission to collect data. In the market it was possible to see why this should no longer being operating, the market lacks all the basic infrastructures and facilities of a secondary market. We were informed that it was a decision of the Local Government Authority (LGA) to move this market to other place, which location is not far from the Mwanza city centre, and those being probably the reasons why there is an apparently lack of investment, and the market is decaying. Trade in this market is done in a very informal basis. It was one of the few markets where we did not had the chance to see the livestock marketing officer issuing movements permits and the accountant collecting tax regarding the cattle being traded. However, it was possible to conduct four interviews in this market, which helped to understand that the majority of the keepers are Wasukuma agro-pastoralist, who largely opt for the feedlot to feed the cattle, using a local strategy to manage land. Animals are also a source of draft power in the homestead. We did four interviews in this market. One of them was with the Chairman of Mwanza City Butcheries Association.

- **Senani (Maswa)**

Senani was the biggest primary markets visited during the fieldwork, one of the interviewees said that this is "*the market*", and we somehow agree with that statement. It was impressive to see how an empty and desert place can be transformed in a few hours into an extraordinary forum of cultural expression. Senani is intense and vibrant,

[109] During the implementation of the Villagisation programmes (1969/76) Tinde was suggested to be one case success in embracing the new approach to improve agricultural sector nation-wide.

and the livestock trade, that should be the main activity, is just one more expression of the huge range of activities that takes place there. Nevertheless, the market is not equipped with some of the basic infrastructures of a livestock equipment, which puts it far from a modern facility to trade cattle. Yet, due to the size and range of activities, it was very interesting to see how people depend on mobile communication to conduct their activities successfully in this geographic context, which is placed in the middle of nowhere. We did four interviews in this market.

- **Shanwa (Maswa)**

This is the main livestock market in Maswa, which is placed in the centre of city. It is a secondary market with decaying infrastructure and facilities. The existing collection yard, dipping tank and loading ramp are obsolete and out of order; the holding pens are below what should be adequate for a secondary market, mainly with the dimension of Shanwa market. Regarding the cattle marketing, similarly to Senani, it is also intense. The traders bargain furiously for the best price and the mobile phone is present, mainly among those *(waswagaji)* with the mission to trek the cattle from different regions to the market or vice versa. The livestock officer permanently issues formal duties, such as tax collection and movement permits. We had the chance to collect very relevant interviews in this market, mainly among the *wasuwagaji*, who have the smallest part of the trade profit, but which are prominently exposed to the dangerous side of the business. To those actors I gave voice in chapter 7, explaining why the mobile phone is so important in their activity. We did five interviews in this market, and before we leave Maswa we had the chance to interview the local Livestock Market Officer. We did six interviews in this market.

- **Waso Market (Loliondo-Ngorongoro division, Arusha)**

Loliondo is the heart of the Maasailand and the house of the Maasai people, which are practicing pastoralism for centuries. The market, Waso, is a small primary market placed in the border region with Kenya (however it is not classified as a border market), which has some important infrastructures that allow keepers and traders to trade the animals in an environment closer to the open market perspective and more aligned with the idea of a formal market. There is an auction area provided with stand, a collection yard with pens that allows moving the cattle to the collection and shipping

yards. The proximity to Kenya gives the market a particular atmosphere. Trade is done mostly with Kenyan traders and the most visible currency is Kenyan Shillings. There are a significant number of good animals of category 1 (cattle and goats) being sold predominantly to that neighbouring country. Consequently, there is significant use of the mobile phones, among the counterparts, and it is recurrent to see traders (eventually agents operating on behalf of Kenyan buyers) using the mobile phone to search for information or instructions before setting up the deal. The intensification of the use of mobile phones increases with livestock arriving at the market. The traditional satellite activities are not so present here as they are in other visited markets. Those are placed in a different area around one-mile distance from the livestock market. Tax is collected, and movement permission issued on a regular basis, mainly for the cattle crossing the border. Nevertheless, those formalities, the traditional way of assessing prevails and the informal network of information seem to be the prevalent source of information feeding this market. Similarly, to other makers visited, there are no evidence supporting the presence and use of the official channel of information (LINKS). Regarding the data collection process, it was not possible to collect information in this market, once we did not received the expected assistance of the livestock marketing officer that should have supported us. Nevertheless, the journey to Loliondo was fruitful, once we had the chance to visit a Maasai village (Maaloni) and a primary school, and as well as to participate in a workshop for Maasai families inhabiting this village. During this workshop we meet the Laiboni of that village, which would concede an important interview in the next day.

- **Malambo Market (Sale-Arusha)**

Malambo has a small livestock market, and trade is done mainly with other producers, selling or exchanging animals for fattening. The market is just an open arena, and not provided with none of the infrastructures inherent to a livestock market facility. Nevertheless, it was very important to visit this market not only for purposes of livestock trade, but mainly to gain perception of the mobile communication process in this region, once the telecommunication infrastructure are sparse increasing difficulties not only in cattle production but as well as in other aspects of the pastoralists family dynamics in Sale division. We did two interviews in this market,

one of them with the only Maasai woman we were able to see trading, once the *market* is perceived by the Maasai as predominantly as a male arena.

- **Meserani Market– Monduli**

Monduli city, where the market is situated, is a sort of gateway from the past to the present. Mesarani is an important secondary market, which is situated approximately 30km Norwest from Arusha city, and it is the biggest in this region. Market activity takes places twice a week (Monday and Tuesday). The first day of the week is allocated for transactions of heavier cattle to be slaughtered or to feed end markets such as Weruweru and Pugu, and the second day to exchange lighter animals among keepers. Normally this market receives cattle from the Lake Zone and other districts from Arusha region. The market is located in a district, which links two distinct landscapes, practices and socioeconomic activities: i.e. between the rural and the urban, or between the traditional versus modern. Trade is done here on a more open basis, and it is possible to understand that there are more sources of information than just the traditional network of friends. For instance, and according to Mr Mlingi (Veterinary Officer) in an interview conducted in that spot, the traditional *dalali* (broker/auctioneer) *and shushushu* (informant) are disappearing in favour of middlemen, once this one has now more access to information made available by the mobile phone. Therefore, it is normal now to find a Maasai person acting as middlemen (new form of livelihood) and they use the mobile phone to contact buyers directly, bypassing the official livestock market structure. Outside of the livestock market it possible to find three parallel markets: the mobile phones and SIMs resellers, the mobile phones repairs and the traditional Maasai remedies seller, and inside the market it is possible to be found the forage market. Regarding the mobile phones resellers, it is possible to find there the main operators, which can be distinguished on the front stage by the big sunny umbrella which advertises the companies. At the backstage, we can find the mobile phone repairer trying to unlock, flashing and refurbished old mobile phones. As already mentioned, the market is above the average size and it is quite well equipped. Almost everything is new here: administrative and sanitarian blocks, collections pens, electric scales, auction area with stands and the loading ramp. However, the electric scale, as in other markets, is not used. In this market, were able to conduct three interviews.

Appendix 6
Ethical Review

University of Edinburgh,

School of Social and Political Studies

RESEARCH AND RESEARCH ETHICS COMMITTEE

Self-Audit Checklist for Level 1 Ethical Review

*The audit is to be conducted by the **Principal Investigator**, except in the following cases:*

- ***Postdoctoral research fellowships** – the applicant in collaboration with the proposed mentor.*
- ***Postgraduate research** (PhD and Masters by Research) – the student together with the supervisor. Note: All research postgraduates should conduct ethical self-audit of their proposed research as part of the proposal process. The audit should be integrated with the student's Review Board.*
- ***Taught Masters dissertation** work and **Undergraduate dissertation/project** work – in many cases this would not require ethical audit, but if it does (for example, if it involves original fieldwork), the student conducts the audit together with the dissertation/project supervisor, who keeps it on file.*

Potential risks to participants and researchers

1 Is it likely that the research will induce any psychological stress or discomfort?

YES☐ NO X

2 Does the research require any physically invasive or potentially physically harmful procedures? YES☐ NO X

3 Does the research involve sensitive topics, such as participants' sexual behaviour or illegal activities, their abuse or exploitation, or their mental health? YES☐ NO X

4 Is it likely that this research will lead to the disclosure of information about child abuse or neglect, or other information that would require the researchers to breach confidentiality conditions agreed with participants? YES☐ NO X

5 Is it likely that participation in this research could adversely affect participants?

YES☐

NO X

6 Is it likely that the research findings could be used in a way that would adversely affect participants or particular groups of people?

YES☐ NO X

7 Will the true purpose of the research be concealed from the participants? YES☐ NO X

8 Is the research likely to involve any psychological or physical risks to the researcher, and/or research assistants, including those recruited locally? YES☐ NO X

Participants

9 Are any of the participants likely to:

be under 18 years of age? YES☐ NO X

be physically or mentally ill? YES☐ NO x

have a disability? YES☐ NO x

be members of a vulnerable or stigmatized minority? YES☐ NO x

be in a dependent relationship with the researchers? YES☐ NO x

have difficulty in reading and/or comprehending any printed material distributed as part of the research process? YES☐ NO X

be vulnerable in other ways? YES☐ NO x

10 Will it be difficult to ascertain whether participants are vulnerable in any of the ways listed above (e.g. where participants are recruited via the internet)? YES☐ NO x

11 Will participants receive any financial or other material benefits because of participation, beyond standard practice for research in your field? YES☐ NO x

Before completing the next sections, please refer to the University Data Protection Policy to ensure that the relevant conditions relating to the processing of personal data under Schedule 2 and 3 are satisfied. Details are Available at: www.recordsmanagement.ed.ac.uk

Confidentiality and handling of data

12 Will the research require the collection of personal information about individuals (including via other organisations such as schools or employers) without their direct consent?

YES☐ NO x

13 Will individual responses be attributed, or will participants be identifiable, without the direct consent of participants? YES☐ NO x

14 Will datafiles/audio/video tapes, etc. be retained after the completion of the study (or beyond a reasonable time period for publication of the results of the study)? YES x NO ☐

15 Will the data be made available for secondary use, without obtaining the consent of participants? YES☐ NO x

Informed consent

16 Will it be difficult to obtain direct consent from participants? YES☐ NO x

Conflict of interest

The University has a 'Policy on the Conflict of Interest', which states that a conflict of interest would arise in cases where an employee of the University might be "compromising research objectivity or independence in return for financial or non-financial benefit for him/herself or for a relative or friend." See: http://www.docs.csg.ed.ac.uk/HumanResources/Policy/Conflict_of_Interest.pdf

Conflict of interest may also include cases where the source of funding raises ethical issues, either because of concerns about the moral standing or activities of the funder, or concerns about the funder's motivation for commissioning the research and the uses to which the research might be put.

The University policy also states that the responsibility for avoiding a conflict of interest, in the first instance, lies with the individual, but that potential conflicts of interest should always be disclosed, normally to the line manager or Head of Department. Failure to disclose a conflict of interest or to cease involvement until the conflict has been resolved may result in disciplinary action and in serious cases could result in dismissal.

17 Does your research involve a conflict of interest as outlined above? YES ☐ NO x